Aug. 31, 1965 J. R. WHITEHURST 3,203,051

EVENER APPARATUS FOR FEEDING PLIABLE MATERIALS

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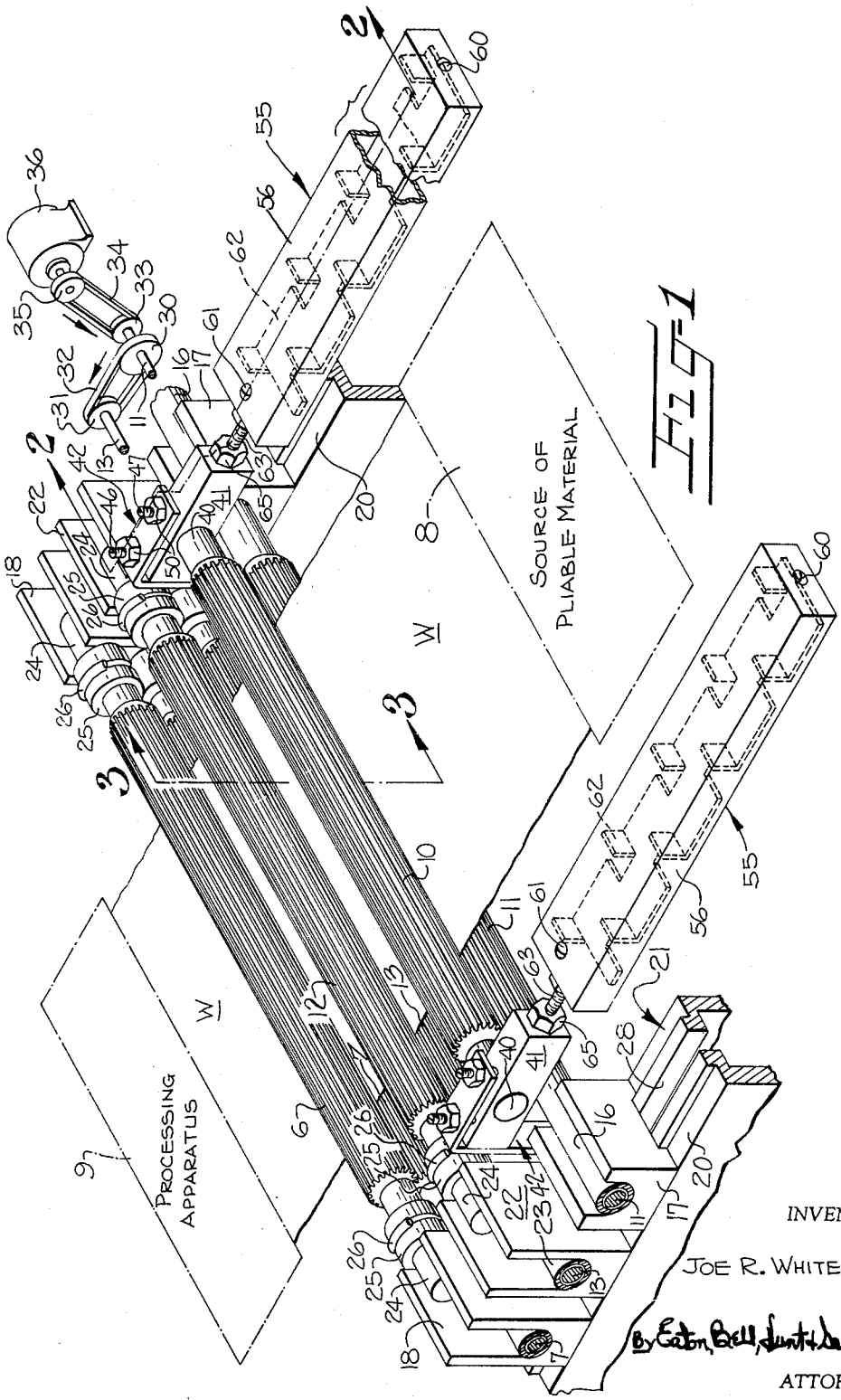


FIG-1

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EVENER APPARATUS FOR FEEDING PLIABLE MATERIALS

Filed July 9, 1962 5 Sheets-Sheet 2

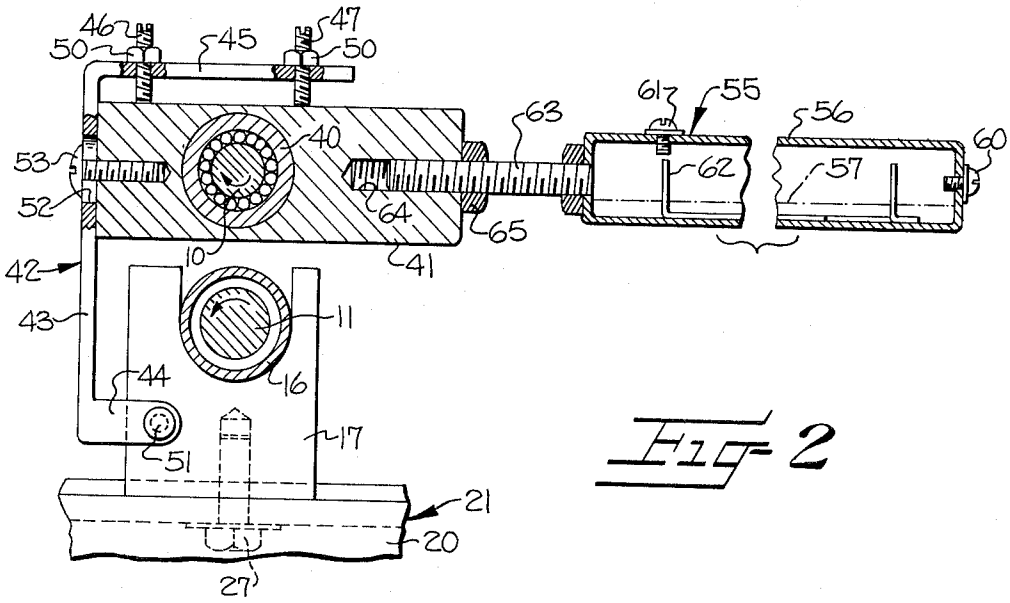


Fig-2

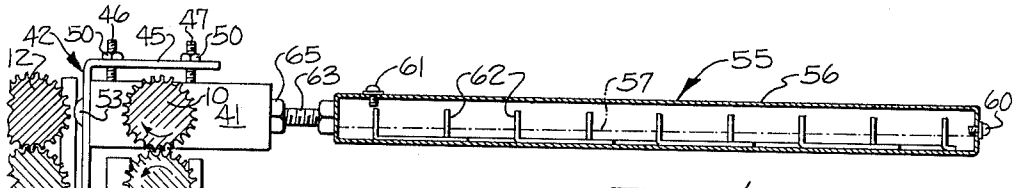


Fig-3

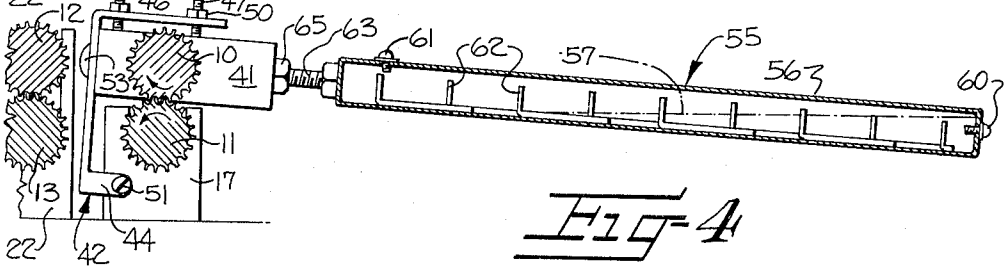


Fig-4

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EVENER APPARATUS FOR FEEDING PLIABLE MATERIALS

Filed July 9, 1962 5 Sheets-Sheet 3

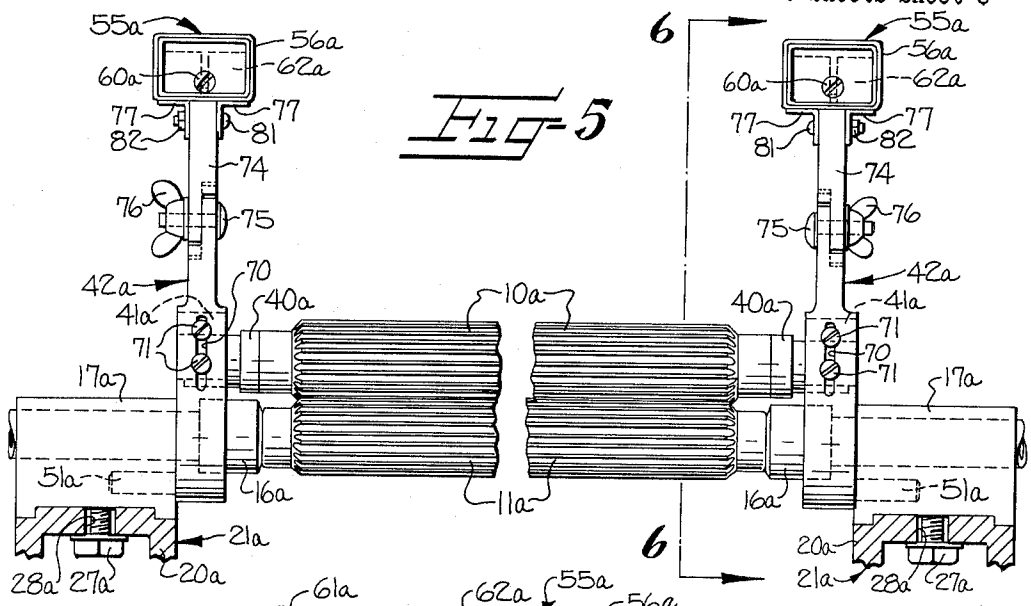


Fig-5

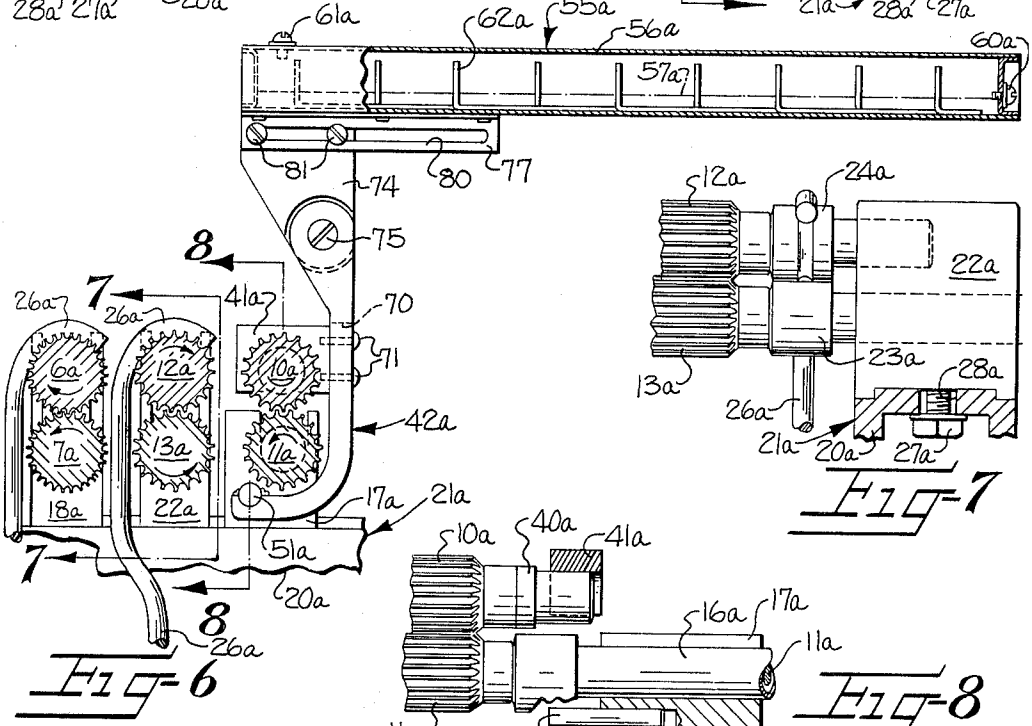


Fig-6

Fig-7

Fig-8

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Aug. 31, 1965 J. R. WHITEHURST 3,203,051

EVENER APPARATUS FOR FEEDING PLIABLE MATERIALS

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5 Sheets-Sheet 4

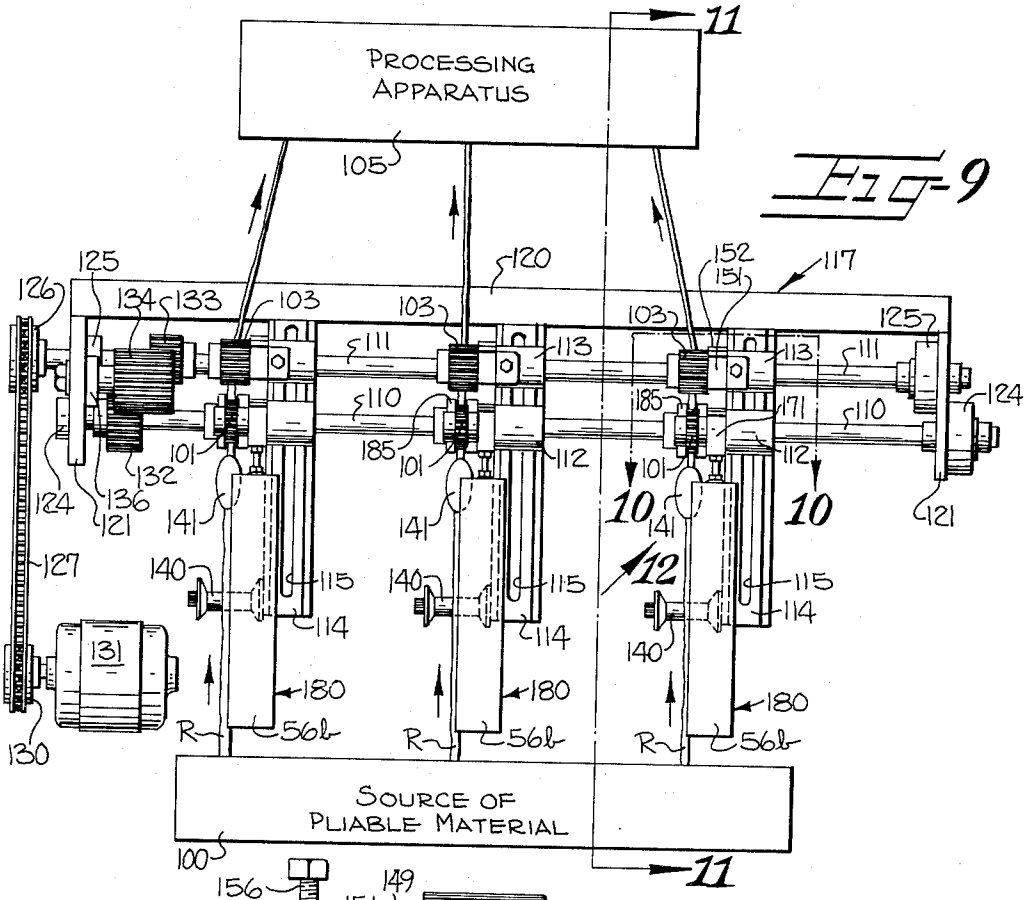


Fig-9

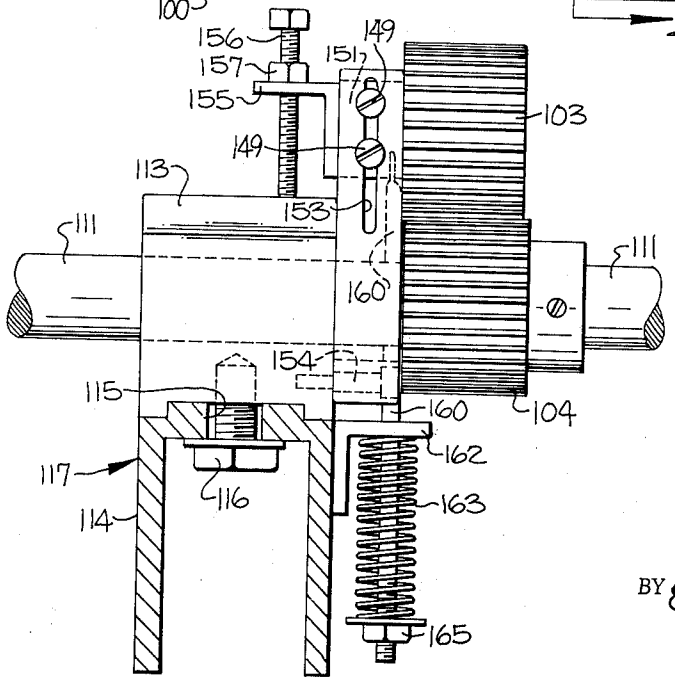


Fig-10

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Aug. 31, 1965 J. R. WHITEHURST 3,203,051

EVENER APPARATUS FOR FEEDING PLIABLE MATERIALS

Filed July 9, 1962 5 Sheets-Sheet 5

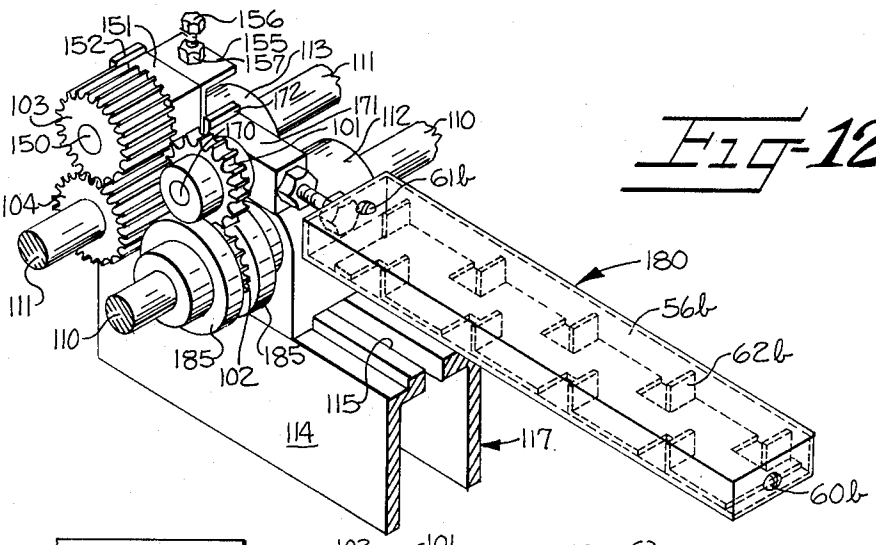


Fig-12

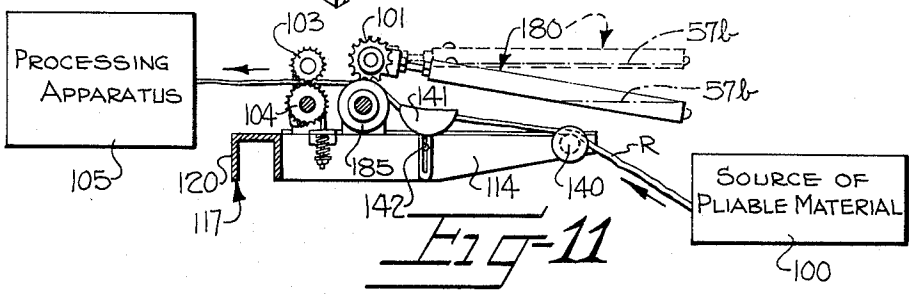


Fig-11

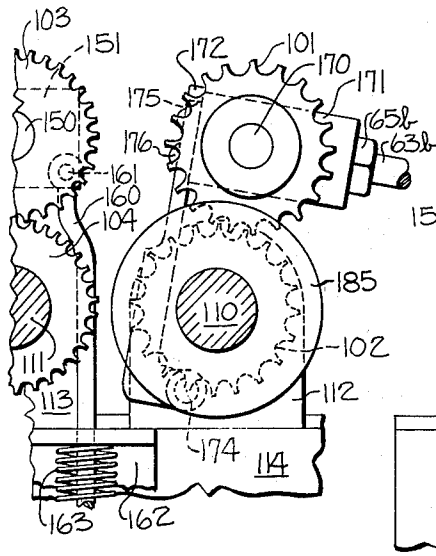


Fig-14

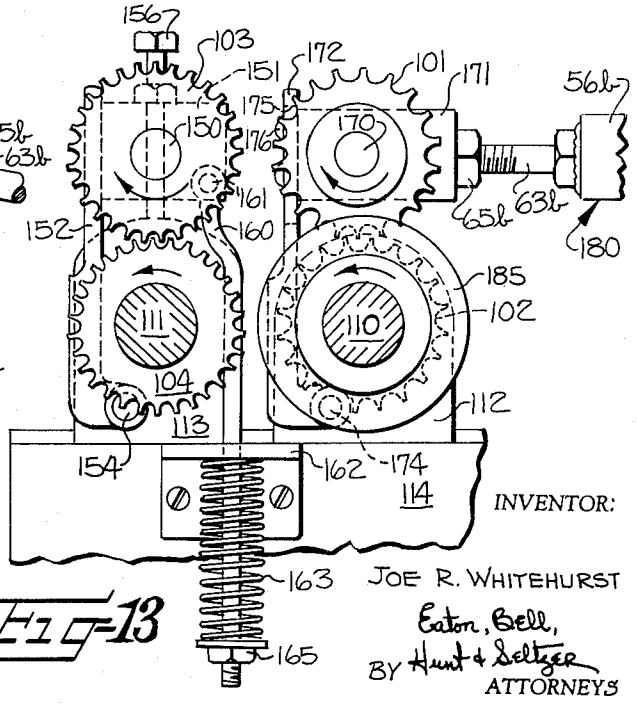


Fig-13

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United States Patent Office 3,203,051 Patented Aug. 31, 1965

3,203,051

EVENER APPARATUS FOR FEEDING PLIABLE MATERIALS

Joe R. Whitehurst, Bessemer City, N.C., assignor to Ideal Industries, Inc., Bessemer City, N.C., a corporation of North Carolina

Filed July 9, 1962, Ser. No. 208,393
19 Claims. (Cl. 19—239)

This invention relates to an improved apparatus and method for feeding uniform masses of pliable web and/or strand material; textile fibers in particular, from a source to a take-up means, such as a drafting, carding, beating or other processing apparatus.

As is well known, the density and/or thickness of individual lengths of fibrous material, such as textile slivers, batts, rovings, yarns and other web or strand materials, are generally inconsistent along such lengths and, where a wide web or several strands or webs are to be fed, corresponding portions thereof may vary in density and/or thickness. It is desirable and generally necessary that the inconsistencies in the density or thickness of such materials be rectified as much as possible at some point between a source of supply and the equipment having a demand for such material.

For example, in order to produce a single drafted sliver of substantially uniform weight per yard from several other slivers, the density or weight of each of said other slivers fed to the drafting zone must be consistent or even. Also, if the web or sliver produced by a carding machine, for example, is to be of uniform density or weight per yard, it is necessary that the batt or lap of the fibers be introduced to the lickerin of the carding machine at a substantially uniform density throughout its width.

My prior U.S. Patent No. 2,738,554, dated March 20, 1956, discloses an evener apparatus comprising weighted, fluted evener rolls resting upon and meshing with a driven fluted bottom roll for delivering substantially uniform amounts of a plurality of carded slivers to the drafting rolls of a drawing frame to produce a single sliver therefrom of substantially uniform density and/or thickness throughout its length. While my prior evener apparatus has performed quite well in many respects, it has been found to be of insufficient sensitivity in the processing of some fibers for cetrain purposes, due to there being very little change in the weight or pressure applied to the fluted evener roll or rolls thereof toward the corresponding driven fluted roll. Further, the nip of the evener and driven rolls of my prior apparatus remains at a fixed distance from the adjacent, faster rotating, drafting rolls to which they feed the slivers and would, therefore, frequently break the ends of the longer of the fibers when the evener roll moved into close or tight engagement with the driven roll, due to the passage of a relatively thin place between such rolls.

It is therefore an object of this invention to provide an improved method and apparatus for feeding pliable material, such as textile fibers, utilizing a driven fluted roll and a fluted evener idler roll meshing with the driven roll and wherein the nip pressure of the rolls is varied and the relative positions of the rolls are varied in such a manner as to control the feeding of the material in accordance with variations in thickness and density thereof with a sensitivity heretofore unattainable to my knowledge.

It is another object of this invention to provide an improved method and means for feeding textile material in which the material is drawn through a pair of rolls, at least one of which is driven, and wherein, contrary to prior practices, the nip pressure of the rolls is increased

when relatively thin places in the material pass therebetween and the nip pressure is reduced when relatively thick places in the material pass between the rolls.

It is another object of this invention to provide an apparatus and method for feeding pliable material of varying thickness through a pair of fluted, intermeshing rolls, and wherein increases in thickness of the pliable material force the rolls into reduced, intermeshing relationship and, conversely, thin places permit the rolls to intermesh to a greater degree, which movement of the rolls by the material also effects a variation in the nip pressure of the rolls to reduce the nip pressure in the event of thick places and, conversely, to increase the nip pressure in the event of thin places.

It is a more specific object of this invention to provide an improved method and apparatus for feeding pliable material uniform amounts by weight per unit of time from a source wherein the pliable material is of varying weight and density at the source and wherein the apparatus for carrying out the method comprises a pair of lower and upper longitudinally fluted and intermeshing feed rolls between which said material may pass from said source with means for driving one only of said rolls. The upper roll is supported for movement along an inclined, preferably arcuate, path generally perpendicular to the axes of said rolls, said inclined path being such that the upper roll moves into closer or tighter intermeshing relationship with the lower or bottom roll as the upper roll moves toward the source and, conversely, the upper roll moves away from tight engagement with the bottom roll with movement thereof along said path in a direction away from said source. Means yieldably urges said upper roll toward said lower roll and toward said source along said inclined path so as to cause the upper roll to move in accordance with variations in thickness or density of the material. Of course, the closer the flutes of the rolls are enmeshed, the faster the material passes through the rolls due to the greater surface area of the rolls that is engaged by the pliable material.

It is still another object of this invention to provide apparatus of the character last described with means for increasing and decreasing the pressure of the yieldable means with respective movements of the upper roll toward and away from the lower roll.

It is another object of this invention to provide an evener apparatus for feeding staple textile fibers including at least one set of primary feed rolls, and at least one set of secondary feed rolls spaced forwardly from the primary feed rolls a distance slightly greater than the average staple length of the fibers to be fed thereby. The primary set of feed rolls comprises an idler fluted, evener roll yieldably urged against or toward a mating driven fluted roll, and the secondary rolls may consist of a pair of mating fluted rolls or either or both of them may be smooth-faced or cushion rolls. However, either or both of the secondary rolls are driven at a slightly higher surface speed than the surface speed of the primary rolls so that the fibers will be advanced by the secondary rolls at a speed at least equal to the maximum speed at which the fibers are fed by the primary rolls whereby a slight attenuation of the fibers occurs between the primary and the secondary sets of rolls.

The speed of the fibers fed by the primary rolls is substantially inversely proportional to the increases and decreases in the density of the fibrous mass as it passes between the primary rolls, depending upon the size and shape of the flutes thereof, since thick or dense places in the mass engage less flute-surface area than do relatively thin or light places and are, therefore, fed at slower speeds than the thin places.

Means are provided for applying a predetermined

optimum pressure to the evener roll toward its driven roll when the mass passing therebetween is of optimum fiber content for the particular weight of the pliable material, the latter means including means for instantaneously and progressively increasing and decreasing the pressure applied to the evener roll in accordance with decreases and increases in the density and/or thickness of the material. Means are also provided for moving the evener roll toward and away from the secondary rolls according to respective increases and decreases in the fibrous mass passing therebetween. Since the fibrous material includes fibers which are longer than the average staple length, the movement of the evener roll away from the secondary rolls, when fibrous material of relatively low fiber content is passing between the primary rolls, is for the purpose of preventing rupture of the longer fibers due to the increased gripping effect applied to the longer fibers at the primary rolls. This increased gripping effect is due, at least in part, to the necessity for increasing the pressure of the evener roll toward the primary bottom feed roll so as to force any portions of the material which are of relatively low fiber content more deeply into the flutes of the primary rolls.

Also, the evener roll must move away from the secondary rolls a substantially greater distance than the extent to which the intermeshing relationship of the flutes of the primary rolls is increased as a portion of the material of low fiber content passes therebetween. Otherwise, the draft on the low fiber content material would be undesirably increased and would frequently cause the material to pull out from between the primary rolls and form non-drafted slubs or wads.

Conversely, when the fiber content of the material increases, the distance between the nips of the primary and secondary rolls must be decreased so that adjacent longer fibers, although released, will have the necessary drafting action on each other and on other adjacent fibers. Also, when the fiber content of the material increases, the material should effect a reduction in the intermeshing relationship between the primary rolls while effecting a reduction in the downward pressure on the evener roll so that the conformation of the material to the configuration of the flutes of the primary rolls is reduced, which reduces the speed of the material being fed thereby.

It is another more specific object of this invention to provide a shiftable weight pressure applying means which is controlled by the position of one of the pair of rolls through which the pliable material is being fed, which shiftable weight in the form illustrated in the drawings takes the form of a hollow lever arm containing a quantity of mercury therein.

Some of the objects of the invention having been stated, other objects will appear as the description proceeds, when taken in connection with the accompanying drawings, in which:

FIGURE 1 is a somewhat schematic isometric view showing one embodiment of the invention particularly devised for feeding a broad pliable web material or several substantially parallel strands or slivers and wherein the length of the material is varied according to variations in mass thereof throughout the width thereof so the web thus fed is of uniform mass, density and thickness;

FIGURE 2 is an enlarged fragmentary vertical sectional view taken substantially along line 2—2 in FIGURE 1 and particularly illustrating the improved mounting and pressure applying means for the corresponding end of the evener roll;

FIGURE 3 is a fragmentary vertical sectional view taken substantially along line 3—3 in FIGURE 1 and showing the position occupied by the evener roll and its pressure applying means when the pliable material passing between the evener roll and its corresponding driven fluted roll is of optimum density and/or thickness for the weight of the web being processed;

FIGURE 4 is a view similar to FIGURE 3, but showing how the evener roll is swung rearwardly and downwardly toward the corresponding driven fluted roll when the slivers or web of pliable or fibrous material becomes relatively thin or light, and also showing how the pressure on the evener roll is then substantially increased;

FIGURE 5 is a rear elevation taken as though looking forwardly from the source of material in FIGURE 1, but showing a second embodiment of the invention particularly directed to the support means and pressure applying means for the evener roll;

FIGURE 6 is a fragmentary transverse vertical sectional view, mostly in elevation, taken substantially along line 6—6 in FIGURE 5;

FIGURES 7 and 8 are fragmentary details showing how corresponding ends of the rolls may be mounted and being taken substantially along lines 7—7 and 8—8, respectively, in FIGURE 6;

FIGURE 9 is a schematic plan view of a third embodiment of the invention which is particularly useful for feeding several strands of pliable or fibrous material;

FIGURE 10 is an enlarged fragmentary elevation, partially in section, taken substantially along line 10—10 in FIGURE 9;

FIGURE 11 is a schematic side elevation of the embodiment of FIGURE 9 showing the pressure applying means in a position such as to feed the material at relatively high speed;

FIGURE 12 is an isometric view looking forwardly and downwardly at the third embodiment of the invention substantially in the direction of the arrow 12 in FIGURE 9;

FIGURES 13 and 14 are fragmentary views of the third form of the invention similar to the respective FIGURES 3 and 4 of the first form of the invention, but are provided to more clearly illustrate the relative displacement between the evener roll and the corresponding driven fluted roll when respective relatively thin and relatively thick or dense places pass therebetween.

Referring to FIGURE 1 in particular, the numerals 10 and 11 indicate a pair of primary feed rolls, and numerals 12 and 13 indicate a pair of secondary feed rolls or drafting rolls which are spaced forwardly of the primary feed rolls 10, 11. As will be later described, the upper primary feed roll 10 serves as an evener roll. These feed rolls are arranged to feed a pliable web W from a source 8 to a suitable processing apparatus 9. The source of supply 8 and processing apparatus 9 are shown schematically in FIGURE 1.

The web W represents any type of pliable material of varying thickness along its width and length. The present method and apparatus are particularly devised for controlled uniform feeding of textile fibers in the form of a batt, slivers, rovings or a loose mass and wherein the original fibers are, collectively, of varying density and are, therefore, of varying thickness. Since the processing apparatus 9 is representative of many different types of processes and/or machines having a continuous demand for uniform amounts of pliable material, it can be assumed that the processing apparatus 9 may be a drafting apparatus embodied in the drafting rolls of a drawing frame, roving frame, spinning frame or the like, or the garnet-like lickerin roll of a carding machine, or the so-called "half-lap" roll of a combing machine.

Accordingly, as a further representation of a drafting zone, a third pair of rolls 6, 7 may be spaced forwardly of secondary rolls 12, 13 and may serve as drafting rolls in conjunction with rolls 12, 13 so that, collectively, the rolls 12, 13 and 6, 7 represent a plurality of sets of drafting rolls. In some instances, the drafting rolls 12, 13, 6, 7 could be considered as parts of the processing apparatus 9 and, therefore the secondary rolls 12, 13 may also be considered as front feed rolls.

In this instance, all six rolls 6, 7 and 10–13 are shown as being relatively long and in the form of fluted rolls. It is necessary that the two primary feed rolls 10, 11 are

fluted longitudinally thereof. However, either or both of the drafting rolls of each set 6, 7 or 12, 13 may be in the form of smooth-faced or cushion rolls, if desired. The bottom primary feed roll 11 has reduced non-fluted end portions 16 which are suitably journaled in bearing blocks or stands 17 adjustably secured to respective bearing supports or frame members 20 which are parts of a common frame generally designated at 21. Substantially U-shaped roll stands 22, 18, similar to, but being somewhat taller than the bearing stands 17, are also suitably adjustably secured to each roll stand support 20.

Reduced opposed ends of the bottom drafting rolls 7, 13 are journaled in bearings 23 mounted in the lower portions of the respective roll stands 18, 22. Opposed ends of the top secondary feed roll or drafting roll 12 are journaled in suitable bearings 24 which are, in turn, guided for vertical movement in the bearing stands or blocks 22. Top drafting roll 6 is supported in blocks 18 in a similar manner to roll 12. Actually, opposed ends of the rolls 6, 7, 11, 12, 13 may be supported in a manner more fully described in U.S. Patent Nos. 2,490,544 and 2,724,623, for example. The bearings 23, 24 may be provided with coinciding enlarged spacer portions 25 of such diameter as to maintain a predetermined clearance between the ridges and grooves defined by the flutes of the rolls 12, 13 in accordance with the desired web or sliver weight per unit length. If desired, suitable yieldable weight means 26 may be provided for urging each end of each top drafting roll 6, 12 downwardly toward the respective bottom drafting roll 7, 13.

The bottom rolls 7, 11, 13 must be driven, the roll 13 being driven at a speed somewhat greater than that of the back roll 11 and at a speed corresponding to the demands or requirements of the roll 7 and/or the apparatus 9 to which the web W is to be fed. Generally, bottom roll 7 would be driven at a greater surface speed than that of roll 13. It will be noted that the primary secondary and third pairs of rolls 10, 11, 12, 13 and 6, 7 are spaced a predetermined distance apart, which distance may be varied in accordance with the characteristics, such as fiber length, of the material to be fed thereby. Therefore, the roll stands 17, 18, 22 are mounted for relative adjustment on the corresponding frame members 20 (see FIGURE 2). In this instance, each support 20 has a longitudinal slot 28 therein (FIGURE 1) which is penetrated by screws 27 (FIGURE 2) threaded into the corresponding roll stands to permit adjustment of each roll stand toward and away from the next adjacent roll stand.

Assuming that the web W is in the form of a batt or lap of cotton fibers having an average staple length of one inch, with the fibers actually varying in length from $\frac{5}{32}$ inch to $1\frac{5}{16}$ inch, as is usual, the center-to-center distance between the pairs of rolls 10, 11 and 12, 13 should then be substantially equal to that of the maximum staple length or slightly less. In actual use, the center-to-center distance between the primary and secondary feed rolls was $1\frac{1}{4}$ inch for the processing of one inch staple fibers and the front or secondary bottom roll 13 was driven at a surface speed approximately one and one-half times the surface speed of the primary bottom feed roll 11, for example.

By way of illustration, it will be observed in the upper portion of FIGURE 1 that corresponding ends of the bottom feed rolls 11, 13 have respective pulleys or sprocket wheels 30, 31 fixed thereon which are interconnected by an endless belt or sprocket chain 32. Sprocket wheel 31 is slightly smaller than sprocket wheel 30 so that the bottom roll 13 rotates at a slightly faster surface speed than the rear bottom roll 11, assuming that both of the bottom rolls 11, 13 are of the same diameter. It will be observed in the upper portion of FIGURE 1 that one reduced end of bottom feed roll 11 also has a pulley or sprocket wheel 33 fixed thereon which may be driven by any suitable means such as a sprocket chain 34, a sprocket wheel 35 and an electric motor 36 which drives the sprocket wheel 35. The pair of drafting rolls 6, 7 are driven at a somewhat faster surface speed than rolls 12, 13 by conventional or other means not shown in the drawings, but which is well known in the art of drafting textile fibers.

Now, in order to accurately control the feeding of web W to the front feed rolls or drafting rolls 12, 13 in accordance with variations in thickness and/or density of the web W and to thereby feed the web W to the processing apparatus 9 at a substantially constant density throughout its length, it is necessary that the primary feed rolls feed the web W toward the secondary feed rolls in uniform amounts per unit of time. In other words, the mass of material leaving primary feed rolls 10, 11 per second must be constant even though such material may vary in length. To this end, novel means are provided for movably supporting and applying varying pressure to the evener roll 10. To this end, each reduced end of the evener roll 10 is journaled, preferably by an anti-friction bearing 40 (FIGURE 2), in a bearing block 41 which is movably supported for movement independently of the respective bearing block 17. Each bearing block 41 is adjustably secured to a movable or pivoted bracket, generally designated at 42.

Each bracket 42 (FIGURE 2) preferably comprises a substantially upright web portion 43, a lower inwardly or rearwardly projecting portion 44 and an upper inwardly projecting portion 45. The upper portion 45 overlies the corresponding bearing block 41 and has a pair of spaced adjustable abutments or set screws 46, 47 threadedly penetrating the same and engaging the upper surface of the corresponding bearing block 41.

For reasons to be later described, set screws 46, 47 preferably engage the upper surface of block 41 adjacent opposite sides of the vertical axis of the corresponding bearing 40 and of evener roll 10. Set screws 46, 47 may be locked in adjusted position by corresponding lock nuts 50. The bridging portion 43 of each bracket 42 may have an adjustment slot 52 therein loosely penetrated by a screw 53 threaded in to block 41 to assist in adjustably securing block 41 to portion 43 of bracket 42.

The inwardly projecting lower portion 44 of each bracket 42 is pivotally connected, as at 51, to the inner face of the corresponding bearing stand or block 17 (FIGURES 2–4). It is important to note that the pivot point 51 of each pivoted bracket 42 is positioned below the level of the horizontal axis of bottom roll 11, and forwardly of and closely adjacent to the normal common vertical plane of the axes of the top and bottom primary feed rolls 10, 11. Thus, upon angular movement of each bracket 42 and evener roll 10, such angular movement has a first component radially of the axis of the bottom primary feed roll 11 and a second component normal to or perpendicular to the first component, and the first component is substantially less than the second component. This insures that, when the upper portion of each bracket 42 swings rearwardly, oppositely from the direction of movement of web W, or in a clockwise direction in FIGURES 2 and 3 to the position of FIGURE 4, for example, the evener roll 10 moves downwardly and rearwardly along an inclined arcuate path, which converges with respect to the periphery of bottom roll 11. Thus, the distance between the longitudinal centers or axes of the rolls 10, 11 gradually diminishes with rearward movement of roll 10 relative to roll 11. It should be noted that any reduction in the distance between the axes of rolls 10, 11 is always substantially less than the distance roll 10 moves rearwardly. Of course, the distance between the bights or nips of the rolls 10, 11 and 12, 13 also gradually increases with such movement of support bracket 42.

Due to the large radius between pivot point 51 and the axis of roll 10 relative to the normal center-to-center distance between rolls 10, 11 and the relative location of pivot point 51, it is apparent that the distance between the

centers of the top and bottom rolls 10, 11 and between the flutes and ridges thereof gradually increases during forward or counterclockwise movement of the pivoted brackets 42 in FIGURES 2, 3 and 4. The distance between the nips or bights of the primary and secondary rolls 10, 11 and 12, 13 also gradually diminishes as the space between the centers of the top and bottom primary feed rolls 10, 11 gradually increases. In other words, during any given extent of angular movement of top roll 10 along the arc generated about pivot point 51, the intermeshing relationship between the flutes of top and bottom rolls 10, 11 is varied at a substantially lesser extent than said given extent of angular movement.

In order to progressively increase the weight or pressure applied to the evener roll as the thickness of web W decreases, and vice versa, and to effect sensitive response, in the movement of evener roll 10 relative to driven primary feed roll 11, to any variation in the density of web W during the course of movement thereof through the rolls 10, 11 and 12, 13, I have provided a self-multiplying or cantilevered shifting weight means or pressure applying device for each of the bearing blocks 41, which self-multiplying pressure applying means is broadly designated at 55 in each instance.

The pressure applying means 55 each comprises an elongate preferably rectangular hollow enclosure or body 56 which may be termed as a moment arm or cantilever arm and which is normally tightly sealed. Body 56 is provided with a pair of removable stoppers 60, 61 in the rearmost and top walls thereof. Stoppers 60, 61 are each in the form of screws which may be removed and then secured in closed position for admitting a suitable liquid 57 into the housing 56. The liquid 57 may be in the form of water, oil or any other type of liquid which will flow quite freely under the influence of gravity. However, it has been found most desirable to use mercury for this purpose, since other liquids may tend to splash about or flow too quickly in either direction or the other with changes in the attitude of housing 56, or such liquids may be of such high viscosity that they would not flow quickly and positively in response to changes in attitude or angularity of the housing 56. Suitable staggered baffles 62 may project upwardly from the bottom wall of housing 56 to prevent undue turbulence of the liquid 57 during changes in the attitude of housing 56.

In order that the housing 56 may be accurately positioned so as to move with the corresponding bearing block 41 in response to changes in the displacement between the flutes and ridges of the rolls 10, 11 due to variations in the density of web W, the housing 56 is adjustably attached to the rear end of the corresponding bearing block 41, for forward and rearward adjustment, by a threaded stud or shaft 63. The rear end of shaft 63 is adjustably secured in the front end of housing 56, and the front end of shaft 63 is threaded into a threaded bore or cavity 64 in bearing block 41 and secured in adjusted position therein by a lock nut 65.

In operation, the set screws 46, 47 and lock screw 53 are adjusted at each end of the rolls 10 so that the ridges of the flutes on the upper roll 10 are spaced a predetermined distance above the bottoms of the grooves of the driven fluted roll 11, during which time the substantially straight bottoms of the housings 56 should occupy substantially horizontal position so the weight of the liquid 57 therein is evenly distributed along the bottom of the corresponding housing 56. This distance between the flutes of the rolls 10, 11 may vary with variations in the average fiber length of different fibers. Thus, the optimum distance between the ridges of the flutes of the rolls 10, 11 may be determined empirically.

However, suitable charts may be made to specify different settings of the rolls 10, 11 and/or 12, 13 for feeding sliver or web material of certain weights. For example, using rolls of 1.175 inches outside diameter having flutes .120 inch deep formed at an included angle between adjacent ridges of 16 degrees, if the sliver is to weigh 55 grains per yard, the ridges of the flutes of one roll should mesh with and extend beyond the ridges and into the flutes of the mating roll .040 inch. This measurement could be determined by measuring from the outside of one roll to the outside of the other roll allowing for the desired meshing relationship; i.e., $1.175''+1.175''-.040=1.310''$ from the bottom surface of roll 11 to the top surface of roll 10 while weight housing 56 occupies substantially horizontal position. In many instances, the optimum relative positions of rolls 10, 11 may be established merely by placing a strand or web of the desired weight, density and thickness between rolls 10, 11, supporting roll 10 on the material and then adjusting screws 46, 47, 53 accordingly.

The amount of liquid 57 in the two housings 56 of FIGURE 1 and the distance that the housings 57 are positioned rearwardly of the axis of the evener roll 10 should also be such as to produce the desired response of the evener roll 10 to variations in web density, and both housings should produce the same response at each end of the top roll 10 to corresponding variations in web density. It is highly desirable, therefore, that the two housings 56 of the two pressure applying devices 55 be as nearly identical as possible and that the same amounts of liquid 57 then be present in both of the housings 56. Of course, where the feed rolls are relatively short, as in the third embodiment of the invention, to be later described, anly a single pressure applying means may be required.

It should be noted that either end of the evener roll 10 may be raised or lowered by variation in density of the web at the corresponding side portion independently of the other. When the web W is of optimum thickness, each cantilever arm or housing 56 is substantially level and the liquid 57 is evenly distributed therein so the center of gravity of each liquid supply 57 is substantially the same as that which the housings would be if they were empty. As each housing 56 tilts downwardly and rearwardly with movement of the evener roll 10 toward roll 11, the effective weight applied to evener roll 10 progressively increases and multiples because the center of gravity of the liquid moves outwardly away from roll 10 and pivot 51 and thereby incresases the moment of arm 56. Of course, the reverse is true when the thickness of web W is increased during movement between rolls 10, 11.

It is apparent that relatively thin places, which are of less mass or density than other places in the web or strand W are forced deeper into the grooves between adjacent flutes at the proximal surfaces of the primary feed rolls 10, 11 than are relatively thick places, thus requiring a substantially greater length of a relatively thin portion of the web to pass between the adjacent surfaces of rolls 10, 11 in a given interval of time when the roll 11 is rotating at a given surface speed than is the case when a relatively thick portion of the web is passing therebetwenn. Thus, relatively thin places are fed by rolls 10, 11 at a faster speed than relatively thick places as the web W or a group of fibers represented by the web W are pulled forwardly and attenuated by the secondary set of feed rolls or drafting rolls, with the result that relatively thin places are attenuated to a lesser degree than relatively thick places and the web W is of substantially uniform density and/or thickness throughout its width and length as it passes from between the secondary set of feed rolls 12, 13.

It is important to note that, whenever a relatively thin place occurs in the web W or in any corresponding portion of web W, such as to cause the corresponding housing 56 to tilt downwardly as the corresponding end of the evener roll 10 moves rearwardly and downwardly against the relatively light or thin portion of the web W, the liquid 57 then quickly moves to the rear or free end of the housing 56 so that the weight of the housing with

respect to its fulcrum 51 is suddenly thrown rearwardly and is thus greatly multiplied, the reverse being true when a relatively thick place occurs in the corresponding portion of web W passing between primary feed rolls 10, 11. It is apparent, therefore, that the evener roll 10 is highly sensitive to any variation in the density and/or thickness of the web W passing between rolls 10, 11.

It is also important to note that the primary set of feed rolls 10, 11 functions to vary the amounts that various portions of the web of different thickness or density are fed; that is, rolls 10, 11 feed relatively thin portions of the web at a relatively fast rate while feeding relatively thick portions at a relatively slow rate so that the mass fed thereby during any given interval is substantially the same as it would be at any other interval corresponding to said given interval. Although this might be satisfactory for some purposes, since the mass of fibers fed in any given period is substantially uniform but may include linear portions of the web of various lengths, the front or secondary pair of feed rolls 12, 13 is provided, which feed rolls are driven at a faster surface speed than the maximum speed at which the thinnest portions of the web W might be fed by the primary feed rolls 10, 11. It has been found that the surface speed of the secondary feed rolls 12, 13 should be approximately one and one-half times the surface speed of the primary bottom feed roll 11 when using this apparatus for feeding cotton fibers of approximately one inch average staple length, for example.

It is necessary that a certain amount of draft is imparted to the web W during its passage between the primary and secondary sets of feed rolls 10, 11 and 12, 13 in order that the mass of fibers may be of uniform density throughout the width and length thereof and may thus be of uniform length per unit weight throughout the width thereof, and it has also been found desirable to retain the core or central fibers in any web or sliver while the outer fibers are moved relative to such central fibers during the drafting operations in order to provide the most efficient uniformity in the web density and weight.

Therefore, it will be noted that when the web W is of relatively high density and is thus relatively thick as it passes between the primary feed rolls, the evener roll 10 is then under relatively light pressure and is then positioned closely adjacent to the nip or bight of the secondary or drafting rolls 12, 13 so that the primary feed rolls 10, 11 then hold back or delay the shorter inside fibers at the core of the corresponding web portion relative to the longer outside fibers. This is not necessary when the web W is relatively light or thin, because the present pressure applying means then produces a greater pressure on the corresponding portion or portions of the web W passing therebetween and, since the top evener roll 10 is then spaced substantially further from the nip or bight of the front or secondary feed rolls 12, 13, this obviates one of the most predominant reasons for the breaking off of the ends of relatively long fibers as the amount of stock between the top evener roll 10 and the bottom roll 11 is decreased, as has heretofore been the case with other types of evener feeding devices such as that disclosed in my said Patent No. 2,738,554. On the other hand, it is important that relatively heavy pressure is applied to the evener roll 10, when a thin place in the web W is passing between rolls 10, 11, to insure that the material is pressed well into the flutes to be quickly and positively accelerated until a thicker web portion engages the rolls.

If desired, suitable means may be provided for limiting the extent to which the pressure applying device 55 can move in a clockwise direction in FIGURE 4 in case the ridges of top roll 10 would not bear against the bottoms of flutes in bottom roll 11 before swinging too far in that direction. Such movement could be limited by engagement of portion 43 of bracket 42 with the bearing 16.

SECOND EMBODIMENT OF THE INVENTION

(Figures 5 through 8)

With the exception of the manner in which the variable weight means or pressure device of the second embodiment of the invention is mounted for applying pressure to opposed ends of the evener roll, the structure illustrated in FIGURES 5–8 may be identical to that illustrated in FIGURES 1–4. Therefore, those parts illustrated in FIGURES 5–8 which are identical to or substantially the same as corresponding parts in FIGURES 1–4 shall bear the same reference characters with the small letter "*a*" added, in order to avoid repetitive description.

It will be observed in FIGURES 5 and 6 that the bracket 42*a* which supports each end of evener roll 10*a* differs from the bracket 42 of the first form of the evener feeding apparatus, although bracket 42*a* is pivotally connected to the bearing block 17*a* in FIGURE 6 at the same position relative to the bottom feed roll 11*a* as a bracket 42 is connected to roll stand 17 in FIGURE 2 relative to roll 11. In this instance, the lower portion of each bracket 42*a* is pivotally connected to the corresponding roll stand or bearing block 17, as at 51*a*, but instead of projecting upwardly between the rear and front sets of rolls as is the case with the first form of the invention, the bracket 42*a* of FIGURE 6 extends rearwardly and then upwardly past the rolls 11*a*, 10*a* and has a longitudinal slot 70 in a medial portion thereof which is loosely penetrated by a pair of screws 71 threaded into the bearing block 41*a* which supports the bearing 40*a* in which the reduced corresponding end of the top evener roll 10*a* is journalled. It is apparent, therefore, that each bearing block 41*a* may be adjusted vertically relative to the corresponding bracket 42*a* in a manner somewhat similar to the bearing blocks 41 of the first form of the invention.

The second embodiment of the invention utilizes a different type of means from that of the first embodiment for adjusting the attitude of the housing 56*a* of the pressure applying device 55*a*. In the second embodiment, the upper portion of evener roll bracket 42*a* has the lower portion of a weight support bracket 74 adjustably secured thereto for pivotal adjustment about an axis above and substantially parallel to the axes of rolls 10*a*, 11*a*, as by a screw 75 and a wing nut 76. Further, in order that the effective pressure of the pressure applying device 55*a* may be distributed over or more closely adjacent to the vertical plane of the axis of the evener roll 10*a* than is the case with the first embodiment of the invention, the lower surface of the weight housing 56*a* has a pair of spaced angle brackets 77 secured to the front portion thereof, and the vertical flange of each of these brackets 77 is provided with a longitudinally extending adjustment slot 80 therein.

The brackets 77 of each weight housing 56*a* are adapted to straddle the upper end of the corresponding weight supporting bracket 74. Bracket 74 has a pair of adjustment screws 81 loosely extending therethrough and penetrating the slots 80 in the corresponding brackets 77. Each screw 81 may have a nut 82 threaded thereon so that the weight housing 56*a* may be adjusted forwardly and rearwardly relative to brackets 74 and 42*a* and relative to the primary feed rolls 10*a*, 11*a*.

It should be noted that the brackets 77 and weight housing 56*a* are located well above the upper rolls 10*a*, 12*a*. Thus, the weight housing 56*a* may be ajdusted so that its front portion extends forwardly of the axis of the evener roll 10*a*, if desired. Since the second embodiment of the evener apparatus functions in substantially the same manner as the first embodiment thereof, a description of the method of operation of the second embodiment of the invention is deemed unnecessary.

THIRD EMBODIMENT OF THE INVENTION

(FIGURES 9 through 14)

The third embodiment of the evener apparatus illustrated in FIGURES 9–14 is quite similar to the first and second embodiments of the apparatus heretofore described, but is particularly adapted for the processing of individual strands of pliable material such as textile slivers, rovings and the like.

Referring to FIGURE 9, in particular, it will be observed that a plurality of strands or slivers R are drawn from a suitable source **100** and each strand R passes through or between an individual pair of primary upper and lower feed rolls **101, 102** and then through or between a secondary pair of upper and lower feed rolls, drafting rolls or delivery rolls **103, 104**, from whence the strands R pass to a suitable processing apparatus generally designated at **105**. In this instance, three strands R are shown leaving the source **100** and, thus, three separate sets of primary and secondary feed rolls are provided in FIGURE 9. All of the primary bottom rolls **102** are driven at the same surface speed and all of the secondary bottom rolls **104** are driven at the same surface speed, but at a surface speed somewhat faster than the surface speed of the primary bottom rolls **102**.

As is the case in the first and second embodiments of the invention, the secondary rolls **103, 104** may be fluted rolls or cushion rolls, as desired. However, the primary rolls **101, 102**, in each instance, must be fluted rolls. All the primary bottom rolls **102** are fixedly mounted on a common driven shaft **110** and all of the secondary bottom rolls **104** are fixedly mounted on a common shaft **111**. The bottom roll shafts **110, 111** are journaled in respective sets of three longitudinally spaced bearing blocks **112, 113**, there being a set of bearing blocks **112, 113** for each set of primary and secondary feed rolls **101–104**.

The bearing blocks **112, 113** are adjustably secured to the upper surfaces of substantially horizontally extending bearing block supports **114**, each of which is constructed in substantially the same manner as the roll stand supports **21** of FIGURE 1. Each support **114** has a longitudinally extending slot **115** therein which is penetrated by screws **116** (FIGURE 10), only one of which is shown, for individually adjustably securing each bearing block **112, 113** to the upper surface of the corresponding bearing block support **114**. It should be noted that there is one of the bearing block supports **114** provided for each pair of bearing blocks **112, 113**.

It is apparent that the bearing blocks **112, 113** are adjustable along the bearing blocks **114** so as to accommodate fibrous strands having staple fibers of varying lengths in the manner set forth with respect to the first embodiment of the evener apparatus. The bearing block supports **114** are parts of a frame generally designated at **117** and are secured to a common transverse frame member **120** which may be suitably supported at the desired elevation to accommodate the source and the processing apparatus **100** and **105**.

Opposed ends of bar **120** have rearwardly extending arms **121** thereon which may be suitably slotted to accommodate the shafts **110, 111** during adjustment of the bearing blocks **112, 113**. Further, arms **121** have corresponding pairs of bearing blocks **124, 125** adjustably secured thereto and in which the corresponding ends of shafts **110, 111** are journaled. It is apparent that bearing blocks **124, 125** must be adjusted with shafts **110, 111** whenever bearing blocks **112, 113** are adjusted.

In order to drive shaft **111** so the surface speed of the secondary rolls **104** is such as to deliver the strands R in accordance with the requirements or demands of the processing apparatus **105**, one end of shaft **111** has a sprocket wheel **126** fixed thereon which is engaged by an endless sprocket chain **127**, the other end of which engages a sprocket wheel **130** driven by an electric motor **131**. It is apparent that the sizes of the sprocket wheels **126, 130** may be varied, or the electric motor **131** may be rheostatically controlled, so as to impart rotation to the shaft **111** and the secondary bottom rolls **104** at the desired speed to deliver the strands R to the processing apparatus **105** at a rate corresponding to the requirements or demands thereof.

In order to insure that the primary bottom rolls **102** are driven at an optimum surface speed somewhat slower than the surface speed of the secondary bottom rolls **104** and to thereby insure at least some attenuation of the fibers of the strands R as they pass from the primary to the secondary rolls, it will be observed in FIGURE 9 that shafts **110, 111** have respective gears **132, 133** fixed thereon which engage a common intermediate gear **134** journaled in a bracket **136** adjustably secured to the corresponding arm **121** of frame **117**. The adjustability of idler gear **134** facilitates changing gear **132** in accordance with the desired relative speed between the two shafts **110, 111**.

In its course from the source to each set of primary feed rolls **101, 102**, each strand R passes over a suitable guide roll **140** mounted on the rear portion of and extending outwardly from the corresponding bearing block support **114**. Each strand R passes forwardly from the corresponding roll **140** and beneath an inverted substantially U-shaped guide **141** which is vertically adjustably secured to one side of the corresponding bearing block **114**, at as **142** (FIGURE 11).

Although all of the primary bottom rolls **102** are fixed on and driven by the common shaft **110** and all of the secondary bottom rolls **104** are fixed on and driven by the common shaft **111**, it is particularly important to note that the top rolls **101, 103** are driven only through engagement with the respective bottom rolls **102, 104** or the material R passing therebetween, in each instance. There are various ways in which each secondary top roll **103** may be supported and it is preferably mounted in the manner to be presently described only because substantially the same type of parts may be used for supporting each secondary top roll **103** as are used for supporting the corresponding evener or primary top roll **101**. Therefore, each secondary top roll **103** is fixed on a relatively short shaft **150** journaled in a bearing block **151**. Each bearing block **151** is adjustably secured to an upright bracket **152** which extends downwardly past the shaft **111** and is pivotally connected to the bearing block **113**, as at **154**. Each bracket **152** has an elongate vertically extending slot **153** therein which is loosely penetrated by screws **149** (FIGURE 10). Screws **149** are threaded into the corresponding block **151**, so the roll **103** may be adjusted to provide the desired clearance between rolls **103, 104** when the roll **103** is positioned directly above roll **104**.

In order to yieldably urge each secondary top roll **103** downwardly toward the corresponding secondary bottom roll **104** while limiting the extent of inter-engagement of the flutes of the latter rolls so as to effect the desired rate of advancement of the strand R by the secondary rolls **103, 104**, each bearing block **151** has an angle clip **155** fixed thereto whose horizontal flange overlies the corresponding bearing block **113**. The overlying flange of each angle clip **155** has an adjustment screw **156** threaded therethrough and adapted to engage the upper surface of the corresponding bearing block **113**. A lock nut **157** may be provided on each screw **156** for maintaing the same in the desired adjusted position.

Each bearing block **151** has the upper end of a link **160** pivotally connected thereto, as at **161**. Each link **160** may also be termed as a weight arm, and extends downwardly past the corresponding shaft **111** and loosely penetrates an angle clip **162** suitably secured to one side of the corresponding bearing block support **114** (FIGURES 10 and 13). The lower portion of each link **160** has a compression spring **163** surrounding the same and whose upper end bears against the lower surface of the corresponding angle clip **162**. The lower end of each spring **163** is maintained in the desired adjusted position

relative to angle clip 162 by a lock nut 165 threaded onto the lower end of the corresponding link 160.

Each evener roll or primary top roll 101 is mounted in a manner somewhat similar to the corresponding secondary top roll 103, with the important exception that it is not limited as to its downward movement by anything other than the material passing between the rolls 101, 102 or by the evener roll 101 pressing against the corresponding driven roll 102. Thus, it will be observed in FIGURES 9, 12, 13 and 14 that each evener roll 101 is fixed on a stub shaft 170 journalled in a bearing block 171 adjustably secured to a substantially upright bracket 172.

The lower portion of each bracket extends downwardly forwardly of the corresponding shaft 110 and then projects rearwardly and is pivotally connected, as at 174, to the corresponding bearing block 112. In order to adjustably secure each bearing block 171 to the corresponding pivoted bracket 172, each bracket 172 has a vertically extending slot 175 therethrough (FIGURE 14) which is loosely penetrated by a pair of screws 176 threaded into the corresponding bearing block 171. It should be noted that bearing block 171 and bracket 172 are quite similar to the bearing blocks 41 and brackets 42 of the first form of the invention shown in FIGURES 1–4. However, the upper portion of the pivoted bracket 172 does not overlie the corresponding bearing block 171 nor are any other means provided for adjusting the bearing block 171 as to angularity to effect corresponding adjustment of a weight or pressure applying device 180 mounted thereon, since only a single bearing block is used for supporting each evener roll 101, and it has been found necessary to provide means for adjusting each pressure applying device, as to angularity, only when two sets of such devices are provided in association with a common top evener roll, such as is the case in the first and second embodiments of the invention.

The pressure applying device 180 for each evener roll 101 of the third embodiment of the evener apparatus may be as it is for each end of the evener roll of either of the embodiments of the evener appartus heretofore described. In this instance, each bearing block 171 of the third embodiment of the apparatus has a pressure applying device 180 attached thereto which is substantially identical to each pressure applying device 55 of the first embodiment of the invention and, accordingly, those parts of each pressure applying device 180 which are identical to or substantially the same as like parts associated with each pressure applying device 55 shall bear the same reference characters wtih the small letter "*b*" applied thereto, where applicable, in order to avoid repetitive description.

Since the third embodiment of the evener apparatus is devised for feeding light filmsy material; textile slivers in particular, means are provided for restricting lateral displacement of the slivers R as they pass between the respective primary feed rolls 101, 102 and so that the evener roll 101 actually detects variations in density of the sliver rather than merely flattening the sliver and broadening out the sliver as it passes between the corresponding set of primary feed rolls 101, 102. To this end, the fluted portions, at least, of the primary feed rolls 101, 102 may be of a width substantially equal to the mean diameter of a sliver of average size, and one of the rolls 101 or 102 is provided with a pair of enlarged portions or flanges at opposite ends of the fluted portion thereof. In this instance, it will be observed in FIGURES 12 and 13 that the primary bottom feed roll 102 is provided with a pair of enlarged portions, flanges or disks 185 which are spaced apart and whose proximal surfaces project outwardly beyond the ridges of the flutes of the corresponding roll 102 so that the fluted portion of the corresponding evener roll 101 is disposed between the proximal surfaces of the enlarged portions 185 of roll 102. Thus, the corresponding sliver or strand R is confined between the enlarged portions or disks 185 and the flutes of the top and bottom primary feed rolls 101, 102 during advancement of the corresponding strand R to the secondary feed rolls 103, 104.

It is apparent that each of the sets of primary and secondary feed rolls 101–104 operates to feed the corresponding strand R substantially the same amount and at the same density, although the density of each strand R may vary considerably at the source 100. This is particularly desirable in cases in which several slivers are directed to a drafting mechanism such as is associated with a drawing frame, spinning frame or the like, although the processing apparatus 105 is not to be construed only as a drafting mechanism. In all other respects, each of the sets of feed rolls 101–104 operates in substantially the same manner as that heretofore described with respect to the feed rolls of the first and second embodiments of the invention and, accordingly, a further description of the method of operation of the third embodiment of the evener apparatus is deemed unnecessary.

In the drawings and specification there have been set forth preferred embodiments of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being defined in the claims.

I claim:

1. Apparatus for feeding pliable material at a variable rate of speed and wherein the material is originally of varying density and/or thickness comprising

(a) a pair of intermeshing fluted first and second feed rolls,

(b) means yieldably urging at least one of said rolls toward the other, and

(c) means supporting said first roll for angular movement along an arc generated about an axis parallel to that of both rolls, said angular movement of said first roll having a first component radially of the axis of said second roll and a second component normal to said first component and being substantially greater than said first component whereby the first roll moves toward the second roll and away from the second roll to a lesser extent than respective angular movements of the first roll in one direction and the opposite direction with said supporting means.

2. Apparatus for feeding pliable material uniform amounts by weight per unit of time from a source wherein the pliable material is of varying weight and density at the source, said apparatus comprising

(a) a pair of lower and upper fluted and intermeshing feed rolls between which said material passes from said source,

(b) means for driving one only of said rolls,

(c) means supporting said upper roll for angular movement along a path toward and away from the source, said angular movement having a first component radially of the axis of said lower roll and a second component normal to said first component, and said first component of the angular movement being substantially less than said second component such that the upper roll moves a relatively short distance into closer intermeshing relationship with the lower roll with substantially greater movement of the upper roll toward the source and the upper roll moves a relatively short distance away from the lower roll with movement thereof a relatively long distance along said path in a direction away from said source, and

(d) means yieldably urging said upper roll toward said lower roll and said source along said path.

3. Apparatus for feeding pliable material uniform amounts by weight per unit of time from a source wherein the pliable material is of varying weight and density at the source, said apparatus comprising

(a) a pair of longitudinally fluted intermeshing lower and upper feed rolls,

(b) means supporting said upper feed roll for angular movement in an arcuate path about an axis spaced below the level of, adjacent to and substantially parallel to the axis of the lower roll, said angular movement of said upper roll having a first component radially of the axis of said lower roll and a second component perpendicular to said first component, and the axis of said supporting means being so positioned relative to said rolls that said first component of said angular movement is substantially less than said second component, and

(c) means yieldably urging said upper roll in one direction along said arcuate path and generally toward the lower roll.

4. Apparatus for feeding textile material uniform amounts by weight from a source wherein the material is of varying weight, density and thickness at the source, said apparatus comprising

(a) a pair of fluted, intermeshing, lower and upper primary feed rolls,

(b) a pair of lower and upper secondary feed rolls adjacent to and spaced forwardly of said primary rolls,

(c) means supporting said upper primary feed roll for angular movement above the lower primary feed roll, but about an axis spaced below the level of, forwardly of, and substantially parallel to the axis of the lower primary roll, said angular movement of said upper primary feed roll having a first component radially of the axis of said lower primary feed roll and a second component normal to said first component, and said first component being substantially less than said second component,

(d) means for rotating said lower primary roll and at least one of said secondary rolls with said one of the secondary rolls rotating at a faster surface speed than said lower primary feed roll, and

(e) weight means yieldably urging said upper primary roll about the axis of said supporting means in a general direction rearwardly and downwardly toward the lower primary roll.

5. Apparatus for feeding textile material uniform amounts by weight from a source wherein the material is of varying weight, density and thickness at the source, said apparatus comprising

(a) a pair of fluted, intermeshing, lower and upper primary feed rolls,

(b) a pair of lower and upper secondary feed rolls adjacent to and spaced forwardly of said primary rolls,

(c) a bearing block supporting said upper primary feed roll for angular movement above said lower primary feed roll about an axis spaced below the level of, forwardly of, and substantially parallel to the axis of the lower primary roll, said angular movement of said upper primary feed roll having a first component radially of the axis of said lower primary feed roll and a second component normal to said first component, and said first component being substantially less than said second component,

(d) means for rotating said lower primary roll and at least one of said secondary rolls with said one of the secondary rolls rotating at a faster surface speed than said lower primary feed roll, and

(e) means yieldably urging said bearing block and said upper primary roll about the axis of said bearing block in a general direction rearwardly and downwardly toward the lower primary roll.

6. Apparatus for continuously feeding uniform amounts of pliable material of varying density from a source to a processing device having a continuous demand for such pliable material, said apparatus comprising

(a) a first pair of upper and lower rolls,

(b) a second pair of upper and lower rolls spaced forwardly of the first pair with respect to the direction in which the material is to be fed,

(c) the rolls of said first pair both being fluted parallel to the axes thereof and being in substantial intermeshing relationship,

(d) means for driving both of said lower rolls while driving the lower roll of the second pair at a faster surface speed than the surface speed of the lower roll of the first pair whereby the pliable material is attenuated between said first and second pairs of rolls,

(e) means supporting the upper roll of said first pair for angular movement along an inclined path having a first component radially of the axis of said lower roll of the first pair and a second component perpendicular to said first component with said first component being substantially less than said second component, and wherein said path is inclined downwardly and rearwardly with respect to the direction of movement of said pliable material through said rolls, and

(f) means yieldably urging the upper roll of said first pair downwardly along said inclined path whereby the closer the intermeshing relationship between the upper and lower rolls of the first pair, the greater the distance between the bights of the first and second pairs of rolls.

7. Apparatus for continuously feeding uniform amounts of pliable material of varying density from a source and forwardly to a processing device having a continuous demand for such pliable material, said apparatus comprising

(a) a first pair of upper and lower rolls,

(b) a second pair of upper and lower rolls spaced forwardly of the first pair with respect to the direction in which the material is to be fed,

(c) the rolls of said first pair both being fluted parallel to the axes thereof and disposed in substantial intermeshing relationship,

(d) means for driving both of said lower rolls while driving the lower roll of the second pair at a faster surface speed than the surface speed of the lower roll of the first pair whereby the pliable material is attenuated between said first and second pairs of rolls,

(e) means supporting the upper roll of said first pair for pivotal movement toward and away from said second pair of rolls and about an axis substantially parallel to the axes of said first pair of rolls,

(f) the relative positions of the axes of the first pair of rolls and the axis of the supporting means being such that the upper roll of the first pair moves toward and away from the lower roll of said first pair to a substanitally lesser extent than the extent of respective rearward and forward movements of the corresponding upper roll with respect to the direction in which the material is to be fed, and

(g) means yieldably urging said upper roll of the first pair about the axis of said supporting means in a rearward direction and generally toward the corresponding lower roll.

8. Apparatus for continuously feeding uniform amounts of pliable material from a source and forwardly to a processing device having a continuous demand for such pliable material, said apparatus comprising

(a) a first pair of upper and lower rolls,

(b) a second pair of upper and lower rolls spaced forwardly of the first pair with respect to the direction in which the material is to be fed,

(c) the rolls of said first pair both being fluted longitudinally thereof and disposed in substantial intermeshing relationship,

(d) means for driving both of said lower rolls while driving the lower roll of the second pair at a faster surface speed than the surface speed of the lower roll of the first pair whereby the pliable material is attenuated between said first and second pairs of rolls,

(e) a bracket supported for pivotal movement toward and away from said second pair of rolls and about an axis substantially parallel to and below the axes of said first pair of rolls,

(f) a bearing block supporting at least one end of said first upper roll and secured to said bracket,

(g) the relative positions of the axis of the first pair of rolls and the axis of said bracket being such that the upper roll of the first pair moves toward and away from the lower roll of said first pair to a substantially lesser extent than the extent of respective rearward and forward movements of the corresponding upper roll with respect to the direction in which the material is to be fed, and

(h) yieldable means urging said upper roll of the first pair about the axis of said supporting means in a rearward direction generally toward the corresponding lower roll.

9. Apparatus for feeding pliable material uniform amounts by weight per unit of time from a source wherein the pliable material is of varying weight and density at the source, said apparatus comprising

(a) a pair of fluted intermeshing lower and upper feed rolls,

(b) means supporting said upper feed roll for movement in an arcuate path above the lower roll about an axis spaced below the level of, to one side of, and substantially parallel to the axis of the lower roll, and

(c) means yieldably urging said upper roll along said path in a general direction toward the lower roll and toward that side of the lower roll opposite from said one side thereof comprising

(1) a hollow cantilever arm fixed to said supporting means and adapted to be partially filled with a supply of liquid, and

(2) said hollow cantilever arm being movable in an arcuate path with said upper feed roll whereby the liquid is displaced and the center of gravity thus moved with movement of the upper feed roll in accordance with variations in thickness of said material.

10. Apparatus for feeding pliable material uniform amounts by weight per unit of time from a source wherein the pliable material is of varying weight and density at the source, said apparatus comprising

(a) a pair of fluted intermeshing lower and upper feed rolls,

(b) means supporting said upper feed roll for angular movement in an arcuate path above the lower roll about an axis spaced below the level of, to one side of, and substantially parallel to the axis of the lower roll, said angular movement of said upper roll having a first component radially of the axis of said lower roll and a second component perpendicular to said first component, and the axis of said supporting means being so positioned relative to said rolls that said first component of said angular movement is substantially less than said second component, and

(c) means yieldably urging said upper roll along said arcuate path in a general direction toward the lower roll and toward that side of the lower roll opposite from said one side thereof and including means for increasing the pressure of the upper roll toward the lower roll with angular movement of the upper roll along said path and toward the lower roll due to a relatively thin place in the material passing between the rolls and for decreasing the pressure of the upper roll toward the lower roll with angular movement of the upper roll along said path and away from the lower roll due to a relatively thick place in the material passing between said rolls.

11. Apparatus for feeding textile material uniform amounts by weight from a source wherein the material is of varying weight, density and thickness at the source, said apparatus comprising

(a) a pair of fluted, intermeshing, lower and upper primary feed rolls,

(b) a pair of lower and upper secondary feed rolls adjacent to and spaced forwardly of said primary rolls,

(c) a bearing block supporting said upper primary feed roll for arcuate movement above said lower primary feed roll about an axis spaced below the level of, to one side of, and substantially parallel to the axis of the lower primary roll,

(d) means for rotating said lower primary roll and at least one of said secondary rolls with said one of the secondary rolls rotating at a faster surface speed than said lower primary feed roll, and

(e) means yieldably urging said bearing block and said upper primary roll about the axis of said bearing block in a general direction toward the lower primary roll and toward that side of the lower primary roll opposite from the side to which the said upper primary roll is supported for pivotal movement, said yieldable means comprising

(1) an elongate weight member carried by and projecting outwardly from said bearing block, and

(2) shifting weight means carried by said weight member and being movable by gravity in accordance with the extent of arcuate movement of said block whereby the center of gravity of said weight member changes relative to said lower primary roll with arcuate movement of said upper primary roll in either direction.

12. Apparatus for feeding textile material uniform amounts by weight from a source wherein the material is of varying weight, density and thickness at the source, said apparatus comprising

(a) a pair of fluted, intermeshing, lower and upper primary feed rolls,

(b) a pair of lower and upper secondary feed rolls adjacent to and spaced forwardly of said primary feed rolls,

(c) a bearing block supporting said upper primary feed roll for arcuate movement above said lower primary feed roll about an axis spaced below the level of, to one side of, and substantially parallel to the axis of the lower primary roll,

(d) means for rotating said lower primary roll and at least one of said secondary rolls with said one of the secondary rolls rotating at a faster surface speed than said lower primary feed roll, and

(e) means yieldably urging said bearing block and said upper primary roll about the axis of said bearing block in a general direction toward the lower primary roll and toward that side of the lower primary roll opposite from the side to which the said upper primary roll is supported for pivotal movement, said yieldable means comprising

(1) an elongate housing containing a freely movable supply of liquid therein, and

(2) means connecting said housing to said bearing block in a cantilevered manner whereby said housing may rock normal to the axis of and with said bearing block and whereby the center of gravity of said liquid changes with changes in the attitude of said housing to produce progressive changes in the pressure on said upper primary roll with arcuate movement thereof.

13. Apparatus according to claim 12, in which said connecting means (2) includes means adjustably support-

ing said housing for adjustment relative to the bearing block and laterally of the axis of said upper primary roll.

14. Apparatus according to claim 12, in which said connecting means (2) includes means for adjustably supporting said housing for angular adjustment about an axis substantially parallel to the axis of said upper primary roll.

15. Apparatus for continuously feeding uniform amounts of pliable material from a source and forwardly to a processing device having a continuous demand for such pliable material, said apparatus comprising

(a) a first pair of upper and lower rolls,

(b) a second pair of upper and lower rolls spaced forwardly of the first pair with respect to the direction in which the material is to be fed,

(c) the rolls of said first pair both being fluted longitudinally thereof and disposed in substantial intermeshing relationship,

(d) means for driving both of said lower rolls while driving the lower roll of the second pair at a faster surface speed than the surface speed of the lower roll of the first pair whereby the pliable material is attenuated between said first and second pairs of rolls,

(e) a bracket supported for pivotal movement about an axis substantially parallel to and below the axes of said first pair of rolls,

(f) a bearing block supporting at least one end of said first upper roll and secured to said bracket,

(g) the relative positions of the axes of the first pair of rolls and the axis of said bracket being such that the upper roll of the first pair moves toward and away from the lower roll of said first pair with respective rearward and forward movements of the corresponding upper roll with respect to the direction in which said material is to be fed, and

(h) yieldable means urging said upper roll of the first pair about the axis of said supporting means in a rearward direction generally toward the corresponding lower roll, said yieldable means including a hollow cantilever arm carried by and projecting rearwardly from an upper portion of said bracket and containing a free-flowing liquid therein.

16. Apparatus for continuously feeding uniform amounts of pliable material from a source and forwardly to a processing device having a continuous demand for such pliable material, said apparatus comprising

(a) a first pair of upper and lower rolls,

(b) a second pair of upper and lower rolls spaced forwardly of the first pair with respect to the direction in which the material is to be fed,

(c) the rolls of said first pair both being fluted longitudinally thereof and disposed in substantial intermeshing relationship,

(d) means for driving both of said lower rolls while driving the lower roll of the second pair at a faster surface speed than the surface speed of the lower roll of the first pair whereby the pliable material is attenuated between said first and second pairs of rolls,

(e) a bracket supported for pivotal movement about an axis substantially parallel to and below the axes of said first pair of rolls,

(f) a bearing block supporting at least one end of said first upper roll and secured to said bracket,

(g) the relative positions of the axes of the first pair of rolls and the axis of said bracket being such that the upper roll of the first pair moves toward and away from the lower roll of said first pair with respective rearward and forward movements of the corresponding upper roll with respect to the direction in which said material is to be fed, and

(h) yieldable means urging said upper roll of the first pair about the axis of said supporting means in a rearward direction generally toward the corresponding lower roll, said yieldable means comprising

(1) a hollow cantilever arm containing a supply of liquid mercury therein, and

(2) means connecting said arm to said bracket for adjustment relative to said bracket and about an axis substantially parallel to the axis of said first upper roll.

17. Apparatus for continuously feeding uniform amounts of pliable material from a source and forwardly to a processing device having a continuous demand for such pliable material, said apparatus comprising

(a) a first pair of upper and lower rolls,

(b) a second pair of upper and lower rolls spaced forwardly of the first pair with respect to the direction in which the material is to be fed,

(c) the rolls of said first pair both being fluted longitudinally thereof and disposed in substantial intermeshing relationship,

(d) means for driving both of said lower rolls while driving the lower roll of the second pair at a faster surface speed than the surface speed of the lower roll of the first pair whereby the pliable material is attenuated between said first and second pairs of rolls,

(e) a bracket supported for pivotal movement about an axis substantially parallel to and below the axes of said first pair of rolls,

(f) a bearing block supporting at least one end of said first upper roll and secured to said bracket,

(g) the relative positions of the axes of the first pair of rolls and the axis of said bracket being such that the upper roll of the first pair moves toward and away from the lower roll of said first pair with respective rearward and forward movements of the corresponding upper roll with respect to the direction in which said material is to be fed, and

(h) yieldable means urging said upper roll of the first pair about the axis of said supporting means in a rearward direction generally toward the corresponding lower roll, said yieldable means comprising

(1) a hollow cantilever arm containing a supply of liquid mercury therein and

(2) means connecting said arm to said bracket for adjustment forwardly and rearwardly relative to said bracket.

18. Apparatus for continuously feeding uniform amounts of pliable material from a source and forwardly to a processing device having a continuous demand for such pliable material, said apparatus comprising

(a) a first pair of upper and lower rolls,

(b) a second pair of upper and lower rolls spaced forwardly of the first pair with respect to the direction in which the material is to be fed,

(c) the rolls of said first pair both being fluted longitudinally thereof and disposed in substantial intermeshing relationship,

(d) means for driving both of said lower rolls while driving the lower roll of the second pair at a faster surface speed than the surface speed of the lower roll of the first pair whereby the pliable material is attenuated between said first and second pairs of rolls,

(e) a bracket supported for pivotal movement about an axis substantially parallel to and below the axes of said first pair of rolls,

(f) a bearing block supporting at least one end of said first upper roll and secured to said bracket,

(g) the relative positions of the axes of the first pair of rolls and the axis of said bracket being such that the upper roll of the first pair moves toward and away from the lower roll of said first pair with respective rearward and forward movements of the corresponding upper roll with respect to the direction in which said material is to be fed, and

(h) yieldable means urging said upper roll of the first pair about the axis of said supporting means in a rearward direction generally toward the corresponding lower roll, said bearing block being so secured to said bracket as to be adjusted relative to said bracket toward and away from said upper roll of the first pair.

19. Apparatus for feeding textile fibers to a drafting mechanism wherein said mechanism includes a plurality of sets of driven drafting rolls; said apparatus comprising

(a) a driven fluted roll having a surface speed less than that of the drafting rolls,

(b) at least one idler fluted evener roll meshing with said driven fluted roll and between which rolls said fibers are drawn from a source and directed to said drafting rolls,

(c) means guiding said evener roll for movement in a lateral path, extending toward and away from said drafting rolls and converging with respect to said driven fluted roll and toward the direction from which said material is being drawn, such that movement of said evener roll along said path in said direction increases the intermeshing relationship between said fluted rolls and movement of said even roll in the opposite direction along said path reduces the intermeshing relationship between said fluted rolls,

and whereby places in the material of high fiber content will move said evener roll toward the sets of drafting rolls while moving said evener roll away from said driven fluted roll and places in the material of relatively low fiber content will permit movement of said evener roll away from the sets of drafting rolls and toward said driven fluted roll, and

(d) means applying an optimum pressure to said evener roll toward said driven roll when said evener roll occupies a predetermined position of minimum intermeshing relationship with said driven roll and being operable to increase the pressure of said evener roll toward said driven fluted roll with movement of said evener roll toward said direction from which said material is being drawn and to decrease the pressure of said evener roll toward said driven fluted roll with movement of said evener roll in the opposite direction along said path.

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