March 5, 1968 J. R. WHITEHURST 3,371,389

SLIP DRAFTING MEANS AND METHOD FOR TEXTILE FIBERS

Filed Oct. 21, 1965 2 Sheets-Sheet 1

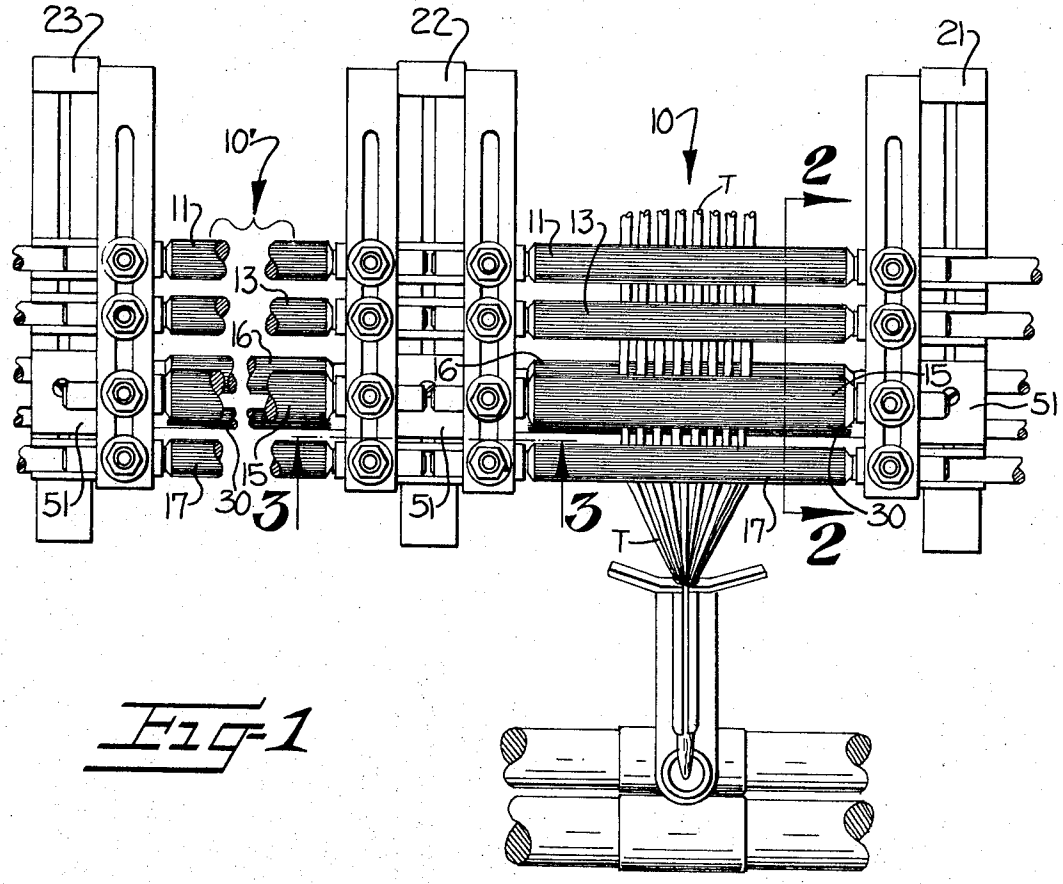


Fig-1

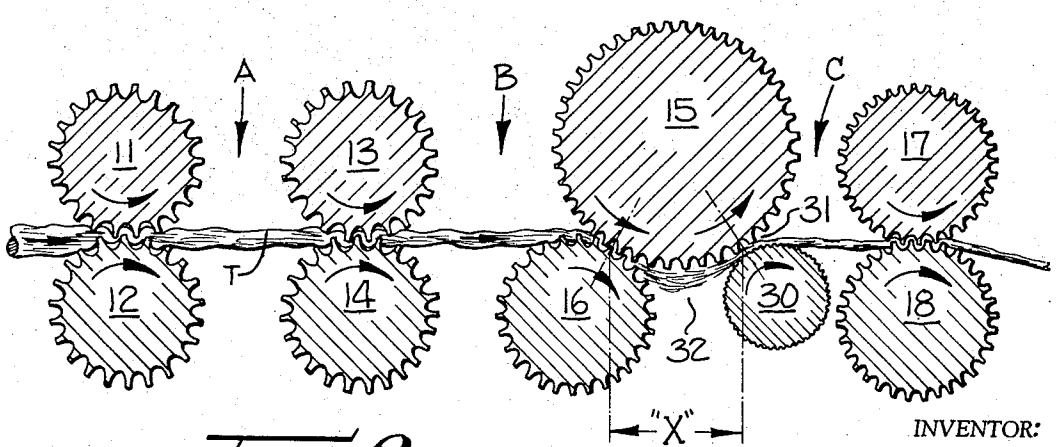


Fig-2

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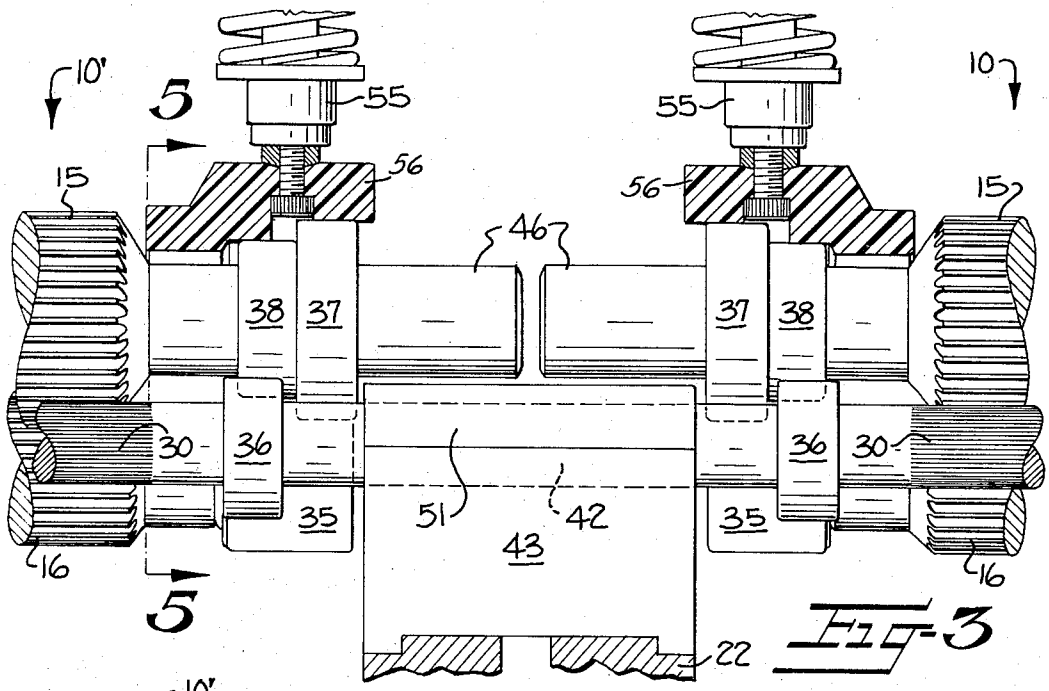


Fig-3

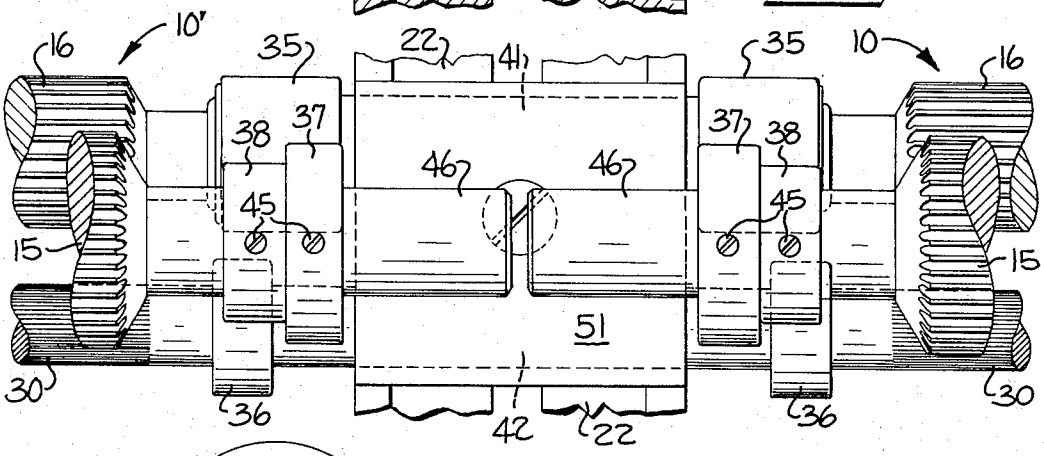


Fig-4

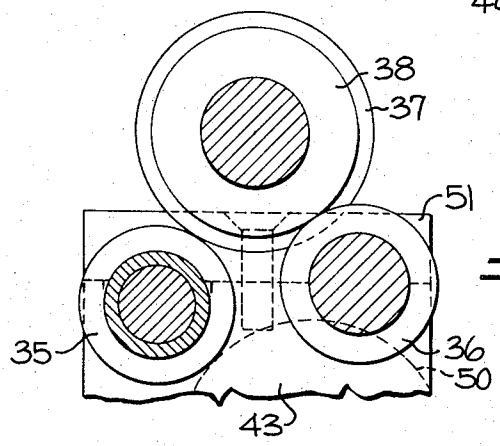


Fig-5

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SLIP DRAFTING MEANS AND METHOD FOR TEXTILE FIBERS

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ABSTRACT OF THE DISCLOSURE

Apparatus and method for imparting draft to textile material while improving the uniformity thereof which includes feeding the textile material into and through a drafting zone and between rotating surfaces in the drafting zone rotating at substantially the same speed but at a slower speed than the rate of feed and defining a restricting passage in the drafting zone adjacent the entrance thereof to impart a sufficient retardant slip draft force on the textile material passing through the restricted passage to create and maintain a reservoir of excess fibers behind the passage in the drafting zone for distribution along the textile material to compensate for variations in weight and density of the textile material being drafted.

This invention relates to an improved method of and means for imparting a retardant slip draft force to textile material being drafted.

It is well known that unspun textile strand and web materials, especially card slivers, generally are of non-uniform weight and density along their length and that the quality of products made therefrom is adversely affected by such non-uniformity.

Various evener and/or slip-drafting methods and devices have been proposed heretofore for use in conjunction with positive drafting apparatus. An evener device is disclosed in my U.S. Patent No. 2,738,554, for example, wherein textile material passes between fluted top and bottom feed rolls, whose variance in meshing relationship determined by variation in density of the material, correspondingly varies the amount of material fed to succeeding drafting rolls. Aprons and slip rolls have also been used in the drafting zone for controlling fibers of varying lengths passing therethrough.

It is an object of this invention to provide a new and novel method of controlling fibers being drafted to substantially improve the uniformity of the textile material as compared to prior known methods and which includes feeding the textile material into and through a drafting zone and between rotating surfaces in the drafting zone rotating at a slower speed than the rate of feed and defining a restricting passage in the drafting zone adjacent the entrance thereof while imparting a sufficient retardant slip draft force on the textile material passing through the restricting passage to create and maintain a reservoir of excess fibers behind the passage in the drafting zone for distribution along the material to compensate for variations in weight and density of the textile material being drafted.

More specifically, it is an object of this invention to provide rotatable means in a drafting zone rotating at a slower peripheral speed than that at which textile material enters and is pulled through the zone and which defines a restricting passage for the textile material serving to impart a retardant slip draft thereto to create and maintain a supply of excess fibers behind the passage formed of the rotatable means for distribution along the material and to compensate for weight and density variations in the material being drafted.

In its preferred embodiment, the invention includes intermeshing fluted rolls through which textile material is directed into the drafting zone, and a slip roll rotating at substantially the same peripheral speed as that of the fluted rolls is spaced closely adjacent one of the fluted rolls and defines therewith said restricting passage. Since the textile material is forced into a tortuous path by the flutes of the intermeshing rolls, the linear speed of the textile material entering the drafting zone is greater than the peripheral speed of the slip roll and the fluted rolls. Thus, even though the textile material may be pulled and attenuated through the drafting zone at a substantially greater speed than the speed of the material entering the drafting zone, the outer fibers are held back under light resistance by the restricting passage between the slip roll and one of the fluted rolls whenever an abnormally thick place is passing through the passage, thus distributing fibers along the material while creating and maintaining a reservoir of excess fibers behind the passage to compensate for weight and density variations in the material being drafted.

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 plan view of a drafting apparatus provided with a preferred slip drafting means according to this invention;

FIGURE 2 is an enlarged transverse vertical sectional view taken along line 2—2 in FIGURE 1;

FIGURE 3 is an enlarged fragmentary view taken substantially along line 3—3 in FIGURE 1;

FIGURE 4 is a plan view of the structure shown in FIGURE 3, omitting the weighting means; and

FIGURE 5 is a fragmentary vertical sectional view taken substantially along line 5—5 in FIGURE 3.

Referring more specifically to the drawings, the apparatus according to this invention is shown in association with a drawing frame representing any type of textile drafting apparatus comprising top and bottom drafting rolls. FIGURE 1 shows two roll sections **10**, **10'** each of which may include four sets of top and bottom rolls **11**, **12**; **13**, **14**; **15**, **16**; and **17**, **18**, the bottom rolls of which are driven in the direction indicated by the arrows in FIGURE 2 at progressively increasing speeds from rear bottom roll **12** to front or delivery bottom roll **18** by means, not shown, but being well known in the art. Thus, the rolls impart draft to the textile material T passing therethrough, and adjacent pairs of rolls define drafting zones A, B, C therebetween into which the textile material is fed by the rearward pair of rolls and pulled forwardly by the adjacent forward pair of rolls in each instance. Rolls **11–14**, **17** and **18** may be fluted as shown in FIGURE 2, or they may have smooth peripheral surfaces, or bottom rolls **12**, **14**, **18** may be fluted and top rolls **11**, **13**, **17** may have smooth peripheral surfaces, as desired. However, according to the method of the instant invention, the top and bottom rolls of one of the pairs in the illustrated embodiment; i.e., rolls **15**, **16**, are fluted and have their nip maintained in predetermined intermeshing relationship so as to feed textile material T into the drafting zone C, for example, at a linear speed substantially exceeding the peripheral speed of rolls **15**, **16**. Rolls **11–14**, **17**, **18** may be rotatably supported on roll stand supports **21–23**, and downward pressure may be applied to top rolls **11**, **13**, **17** by corresponding weighting or pressure devices well known in the art. Of course, if rolls **11–14**, **17**, **18** are fluted, suitable spacing means such as is disclosed in U.S. Patents Nos. 2,610,363 and 2,724,623 may be provided for limiting the intermeshing relationship of these rolls.

In order to form a restricting passage in drafting zone C and impart a slip draft force on the textile material to create and maintain a reservoir of excess fibers for distribution along the textile material T, I have provided a suitably driven rotatable means, embodied in a slip roll **30**, positioned in drafting zone C closely adjacent one of the fluted drafting rolls which feeds textile material into drafting zone C. As shown, slip roll **30** is positioned closely adjacent top roll **15** and cooperates therewith to define a restricting passage **31** therebetween and to impart a retardant slip draft force to textile material passing therethrough and create and maintain a reservoir **32** of excess fibers between the nip of rolls **15, 16** and the spaced proximal surfaces or nip of rolls **15, 30**. Preferably, top roll **15** is of substantially larger diameter than rolls **16, 30** so roll **30** may be spaced a substantial distance forwardly of roll **16** while being positioned in close proximity to roll **15**. Any suitable means may be provided for maintaining rolls **15, 16** in the desired intermeshing relationship and for maintaining the periphery of slip roll **30** in spaced relation of the periphery of top roll **15**. To this end, it will be observed in FIGURES 3, 4 and 5 that each end of bottom drafting roll **16** is provided with a spacing collar or ring **35** and each end of slip roll **30** is provided with a spacing collar or ring **36**. Each end of top drafting roll **15** is provided with a pair of spacing collars or rings **37, 38** of different diameters which rest upon the respective collars **35, 36**. In this instance, collars **35, 36** are formed as enlarged portions of bearings **41, 42**, preferably of anti-friction type in which corresponding reduced ends of rolls **16, 30** are journaled.

It is preferred that the rolls **16, 30** in adjacent roll sections **10, 10'** are interconnected to facilitate driving these rolls by means positioned at either or both sides of the drawing frame, as is usual. Therefore, bearings **41, 42** are shown in the form of roller-neck bearings positioned in U-shaped grooves of a corresponding bearing block **43** in each instance adjustably mounted on the corresponding roll stand supports. As shown in FIGURES 3, 4 and 5, bearing block **43** is adjustably secured to roll stand support **22**. It is desirable, in some instances, to adjust or vary the width of passage **31** (FIGURE 2); i.e., the distance between rolls **15, 30**, to accommodate different desired weights of textile material, although the maximum intermeshing depth of rolls **15, 16** may remain constant for different desired weights of textile material. Accordingly, spacing collars **37, 38** are preferably removably secured, as by set screws **45**, on an elongate bearing **46**, in each instance, in which the reduced corresponding end of top roll **15** is journaled. Thus, although it normally is not necessary to change the size of the larger collar **37**, any time that the width of passage **31** is to be changed, it is merely necessary to slide the bearing **46** off the corresponding reduced end of roll **15** and replace the collar **38** thereon with another of the desired diameter, and then slide the corresponding bearing **46** back onto the corresponding end of the roll **15**.

Any suitable means may be provided for driving slip roll **30** at a peripheral speed substantially the same as the peripheral speed of top roll **15** so as to avoid scuffing or undesirable relative displacement of fibers in their course through passage **31**. For example, spur gears of the same diameter as the outer peripheral diameters of rolls **16, 30** may be mounted thereon and engaged by a common idler spur gear represented at **50** by broken lines in FIGURE 5. Accordingly, a cap plate **51** may be secured upon each bearing block **43** to engage the upper surfaces of bearings **41, 42** to insure that they are not displaced upwardly due to the gears thereon meshing with the gear **50** therebeneath. The peripheral surface of at least that much of the slip roll **30** engaged by textile material T should be roughened so it has a frictional resistance effect on the textile material substantially equal to the effective frictional resistance effect of the outer periphery of fluted top roll **15** so that both the upper and lower surfaces of the textile material are subjected to the same retardant slip draft force when passing through passage **31**. Satisfactory results have been obtained by providing very small flutes longitudinally of the slip roll **30** as compared to the size of the flutes of fluted rolls **15, 16**. In order to apply the desired downward pressure or weight to roll **15**, conventional spring pressed members **55** (FIGURE 3) may be provided with stepped foot members **56** for engaging each pair of collars **37, 38** on opposite ends of roll **15** of each roll section **10, 10'**.

As is known, slip drafting devices are particularly useful in conjunction with positive drafting mechanisms when processing blends of fibers which vary considerably in length. In the slip drafting of textile fibers, I have found that the longer the drafting zone with respect to the fibers being drafted and the higher the linear speed of the textile material through the drafting zone, the greater is the separation or "blow-up" of the fibers creating a problem of non-uniformity. Apparently such "blow-up" of the fibers is caused by the tendency of the trailing ends of the relatively long fibers to whip about following their release from the drafting rolls feeding the textile material into the particular drafting zone. In instances in which the textile material includes a blend of short fibers with substantialy longer fibers, if the "blow-up" is not controlled or confined, undesirable large amounts of the short fibers escape from the textile material, notwithstanding the fact that many of the fibers, including the longer fibers, become misaligned and form into masses of irregular density. I have also found that, by providing a restricting passage, such as passage **31** of FIGURE 2, at a predetermined point in the drafting zone, the "blow-up" of the fibers is substantially reduced or eliminated. The point at which the passage **31** is located with respect to the nip of rolls **15, 16** may be constant for many different lengths of fibers provided that it is located a sufficient distance forward of the nip of rolls **15, 16** to permit the formation of the reservoir **32** of excess fibers, and at the point at which the "blow-up" of the fibers would originate in the drafting zone C if the passage **31** was not provided. The "blow-up" point usually is located a lesser distance forwardly of the nip of the feeding rolls and a lesser distance rearwardly of the nip of the delivery rolls **17, 18** than the average staple length of the longer fibers of a particular blend. For example, in a drafting zone of about 2¼" from the nip of the feed rolls **15, 16** to the nip of the delivery rolls **17, 18**, processing a blend of cotton and synthetic or rayon textile material having fibers varying in average length from about ⅞ to 2 inches, the "blow-up" occurs at a point substantially midway of the drafting zone. Thus in this instance, the slip roll **30** is positioned so the nip of rolls **15, 30** is about the same distance "X" (FIGURE 2) from the nip of rolls **15, 16** as that of the mean center of the aforementioned blow-up point, which is about midway of the drafting zone C, thus substantially preventing separation of the fibers being drafted in zone C. The width of passage **31** defined by rolls **15, 30** in this instance was about .007 inch, but may be varied from about .005 inch to .040 inch, depending upon the weight and type of fibers being drafted. The draft effected in zone C may be as high as about 7:1; i.e., the surface speed of rolls **17, 18** may be as much as about seven times that of rolls **15, 16**.

In operation, the textile material T is crimped and then fed into drafting zone C by fluted rolls **15, 16**, the rolls causing the textile material to enter reservoir **32** at substantially greater linear speed than the surface speed of rolls **15, 30**. Although delivery rolls **17, 18** draw material from reservoir **32** as substantially greater speed than the linear speed of material entering reservoir **32**, passage **31** restricts flow of textile material because of the material being lightly condensed between rolls **15, 30** and excess fibers tend to build up between the nips of rolls **15, 16; 15, 30** substantially as shown in FIGURE 2. This build-up of excess fibers is greater during movement

of abnormally thick places in the textile material through drafting zone C than is the case when thinner places are moving through zone C so some of the fibers lag back of the thick places and are redistributed mostly in the thinner places. It should be noted that, although the retardant slip draft force acting on the textile material moving through passage 31 creates and maintains excess fibers in reservoir 32 at all times during drafting, the fibers also are in relative motion and are being distributed along the mass of the textile material at all times so there is no noticeable increase in waste fibers generated in zone C as compared to other known slip drafting methods. On the other hand, the crimp previously imparted to the textile material T by fluted rolls 15, 16, as well as by rolls 11–14 (if rolls 11–14 are fluted), aids materially in the cohesion of small or short fibers to the longer fibers during movement of textile material T through passage 31, since it is important that all the fibers ultimately move through passage 31 and are subjected to the positive draft in drafting zone C.

As an example of the length of textile material which may be introduced into reservoir 32 relative to the surface speed of rolls 15, 16, 30, a standard fluted roll having an outside diameter of 1.175 inches was used for roll 16 (FIGURE 2) and the tortuous path of the textile material through rolls 15, 16 was such that about 5.040 inches of textile material were introduced into drafting zone C during each revolution of roll 16 and in which the periphery of roll 16 moved 3,691 inches. Thus, during each revolution of roll 16, about 1.35 inches of textile material were introduced into zone C in excess of the circumference of roll C. In other words, the linear speed of the textile material entering zone C was about 36.7% greater than the surface speed of rolls 15, 30.

It is thus seen that I have provided an improved slip drafting means and method which results in improved uniformity of textile material. Although the present invention is described in conjunction with a drawing frame, it is to be distinctly understood that the method and apparatus are applicable to other types of drafting mechanisms and may be used for feeding textile material to other textile processing machinery. It is contemplated, for example, that the drawing rolls 11–14, 17, 18 may be omitted and that a gilling machine may be substituted for drafting rolls 17, 18, or a lickerin feed roll of a carding machine may be substituted for rolls 17, 18, all without departing from the spirit of the invention.

In the drawings and specification there has been set forth a preferred embodiment 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. A method of imparting draft to fibrous textile material while improving the uniformity thereof comprising the steps of feeding the textile material into and through a drafting zone while creating and maintaining a reservoir of excess fibers in the drafting zone for distribution along the textile material being drafted to compensate for variations in weight and density thereof by applying a sufficient retardant slip draft force to the textile material by directing the textile material through a restricting passage defined between rotating surfaces rotating at the same speed to avoid scuffing the textile material but moving at a slower speed than the rate of feed of the textile material to thereby obtain improved distribution of the fibers in the textile material to enhance the uniformity thereof.

2. A method according to claim 1, which includes the step of imparting crimp to the material before it enters said drafting zone.

3. A method according to claim 1, in which the fibrous material is formed of fibers of substantially varying length which tend to blow up in a predetermined area in the drafting zone, and wherein the retardant slip draft force is applied to the material at said area to prevent blow-up of the fibers in the drafting zone.

4. Apparatus for imparting draft to fibrous textile material while improving the uniformity thereof comprising means defining a drafting zone and including means defining cooperating moving surfaces for feeding the textile material and means for pulling the textile material forwardly from said feeding means to impart draft to the textile material, means in the drafting zone adjacent the entrance thereof defining cooperating moving surfaces positioned in closely spaced relation to each other within the range of .005 to .040 inch and defining therebetween a restricting passage through which the textile material passes in its course from said feeding means to said pulling means, said moving surfaces defining said restricting passage moving at substantially the same peripheral speed to prevent scuffing of the textile material passing therebetween but moving at a slower speed than the rate of feed of the textile material to impart a sufficient retardant slip draft force to the textile material passing through the restricting passage to create and maintain a reservoir of excess fibers behind the passage in the drafting zone for distribution along the material to compensate for variations in weight and density of the textile material being drafted.

5. Apparatus according to claim 4, in which the most proximate portions of said moving surfaces defining said restricting passage are located a distance forwardly of said moving surfaces defining said feeding means less than the maximum length of the fibers in the textile material.

6. Apparatus according to claim 4, in which said feeding means includes means for imparting crimp to the textile material.

7. Apparatus for imparting draft to fibrous textile material while improving the uniformity thereof comprising means defining a drafting zone and including a pair of intermeshing fluted feed rolls for feeding the textile material at a faster linear speed than the peripheral speed of the feed rolls and means for pulling the textile material forwardly from said feed rolls to impart draft to the material, a rotating roll in the drafting zone positioned in closely spaced relation adjacent one of said fluted feed rolls within the range of .005 to .040 inch thereto and defining therebetween a restricting passage in the drafting zone adjacent the entrance thereof through which the material passes in its course from the feed rolls to the pulling means, said rotating roll rotating at a slower speed than the rate of feed of the textile material and at substantially the same peripheral speed as said adjacent fluted feed roll to prevent scuffing of the textile material passing through the restricting passage therebetween, and said rotating roll cooperating with said adjacent fluted feed roll to impart a sufficient retardant slip draft force to the textile material passing through the restricting passage to create and maintain a reservoir of excess fibers behind the passage in the drafting zone for distribution along the material to compensate for variations in weight and density of the textile material being drafted.

8. Apparatus according to claim 7 wherein said rotating roll is spaced a substantial distance forwardly of the nip of said intermeshing fluted feed rolls.

9. Apparatus according to claim 7 wherein said rotating roll has a roughened peripheral surface for increasing its frictional resistance to movement of textile material in engagement therewith.

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DORSEY NEWTON, *Primary Examiner.*