May 3, 1960 M. G. WHITEHURST ET AL 2,935,435

METHOD OF INCREASING FIBER LENGTH WHILE DRAFTING

Filed July 3, 1958 5 Sheets-Sheet 1

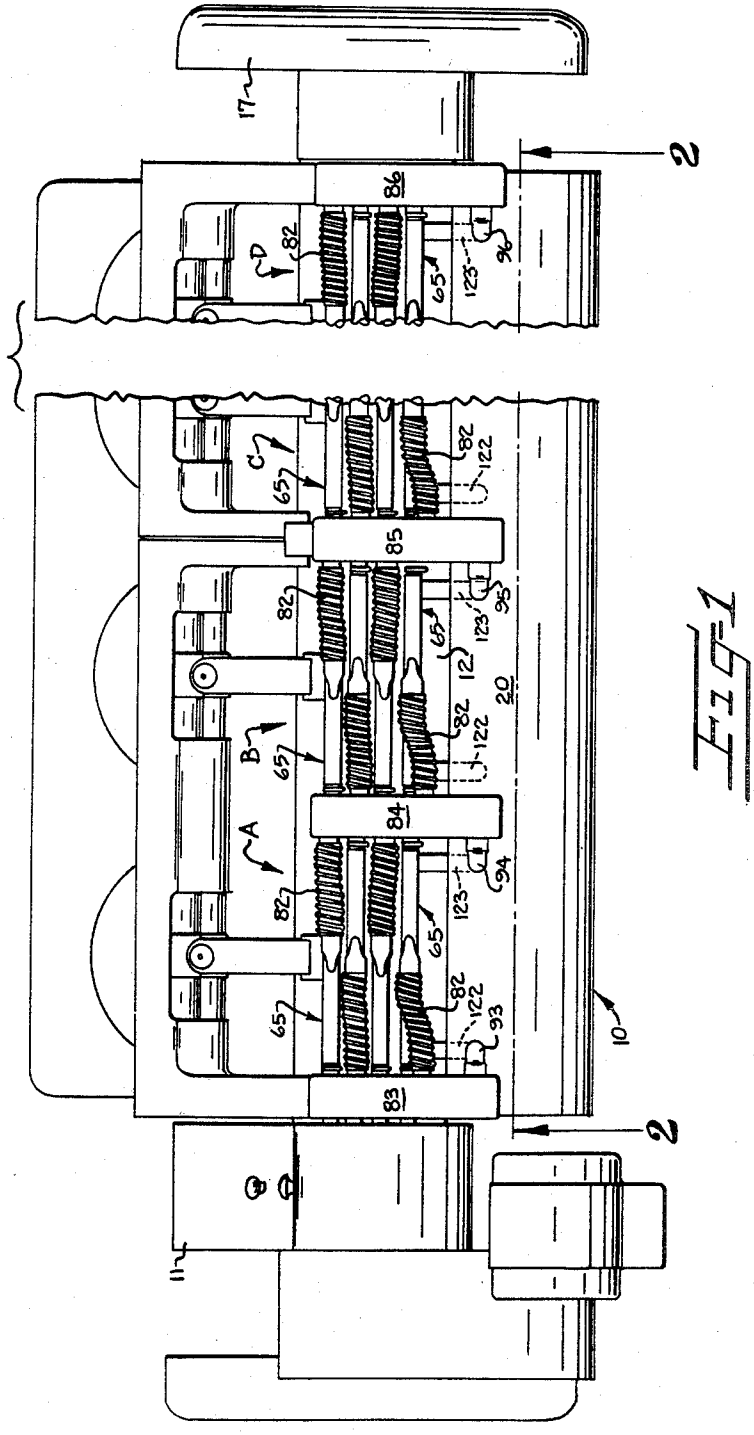


FIG. 1

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METHOD OF INCREASING FIBER LENGTH WHILE DRAFTING

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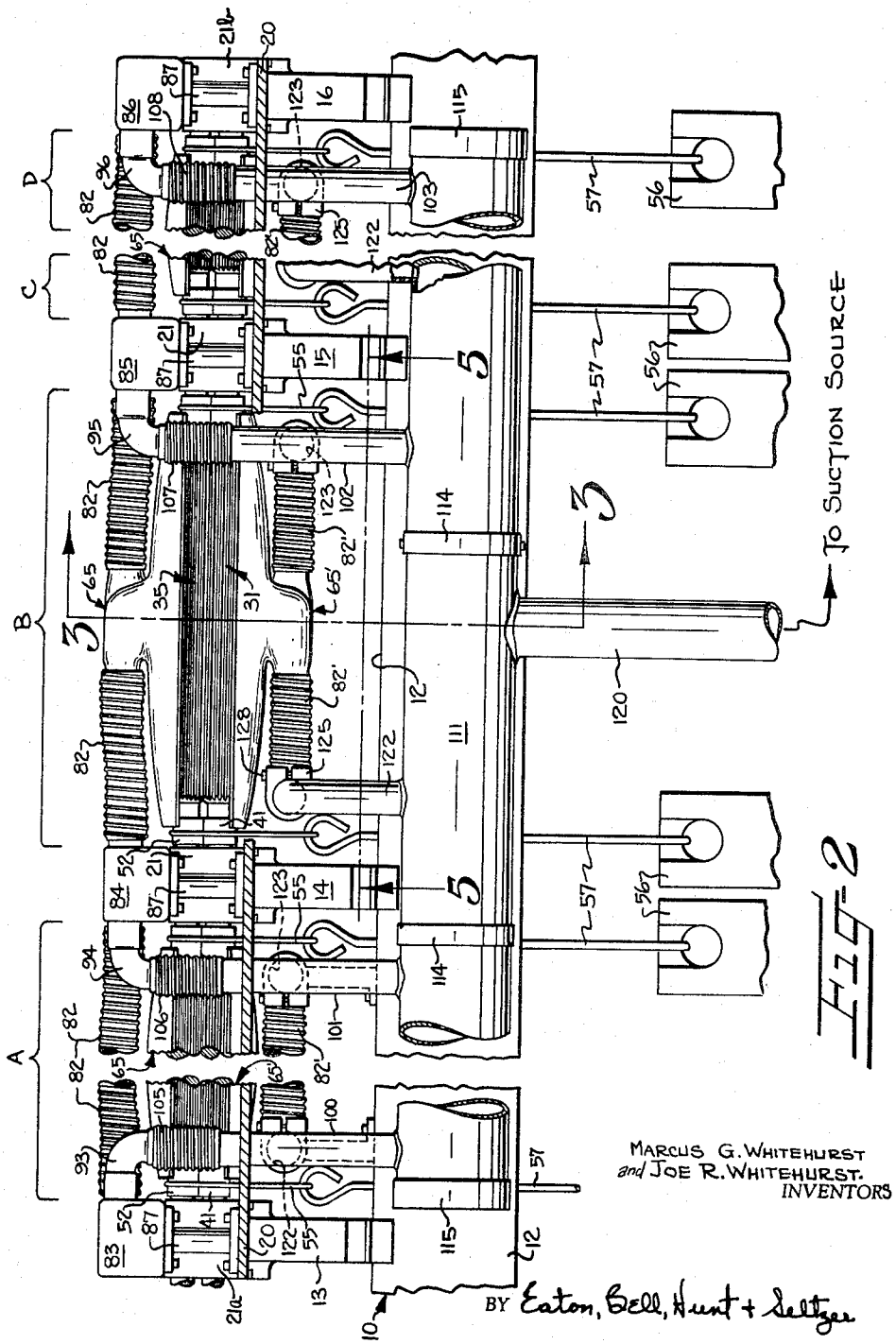


FIG. 2

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METHOD OF INCREASING FIBER LENGTH WHILE DRAFTING

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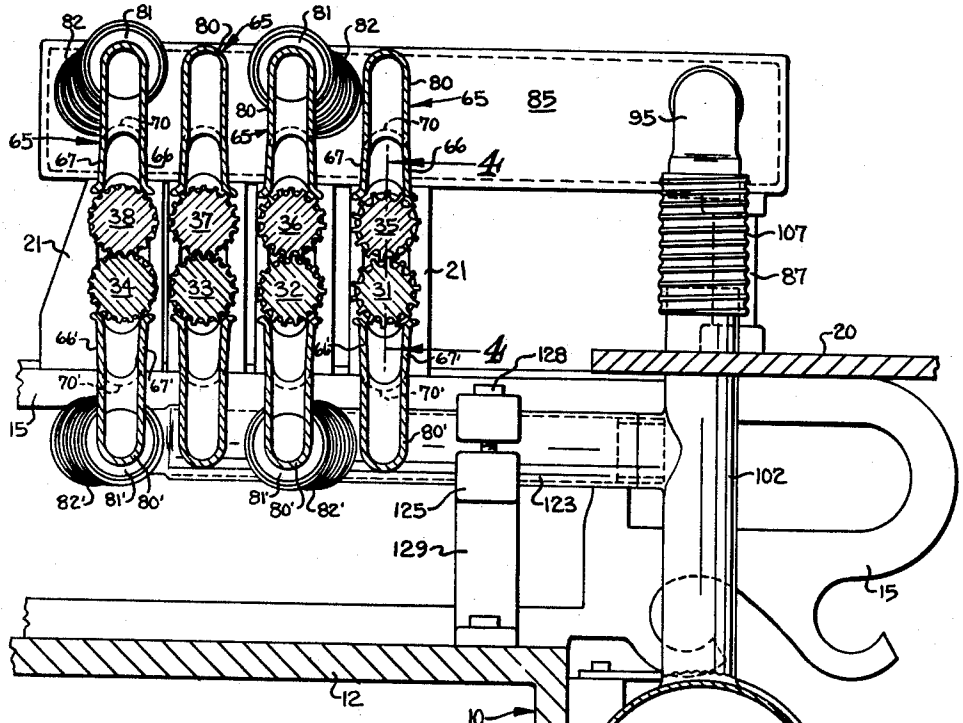


FIG-3

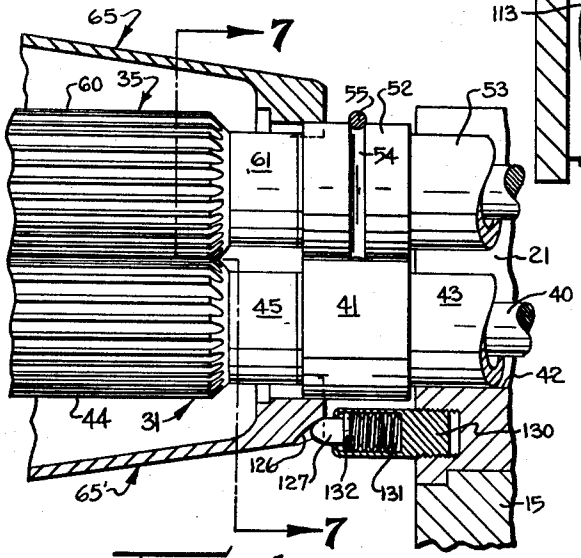


FIG-4

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METHOD OF INCREASING FIBER LENGTH WHILE DRAFTING

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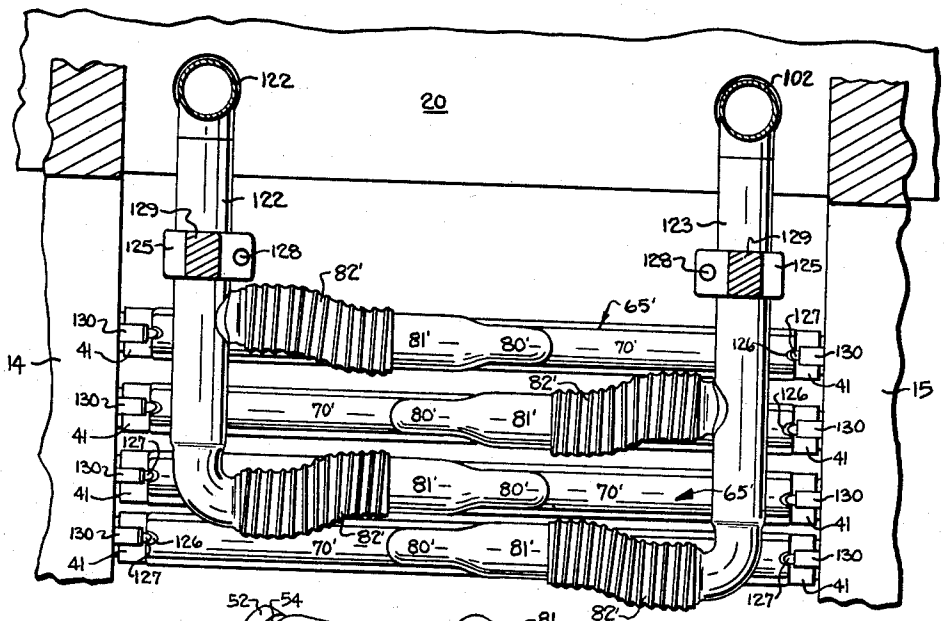


Fig-5

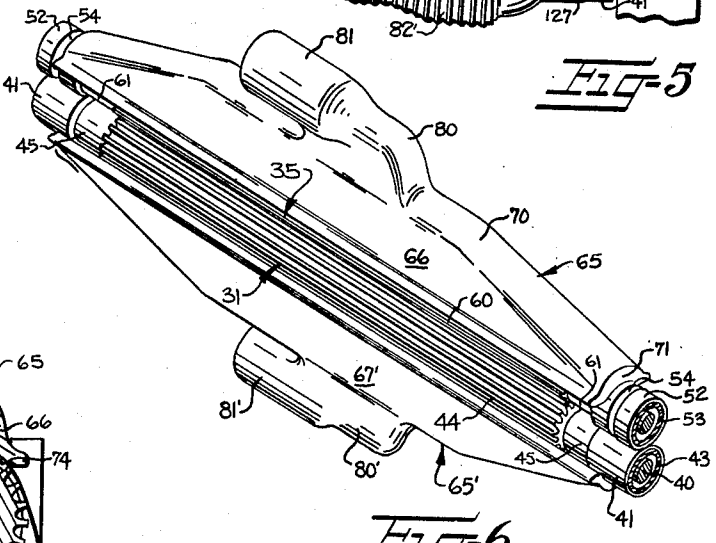


Fig-6

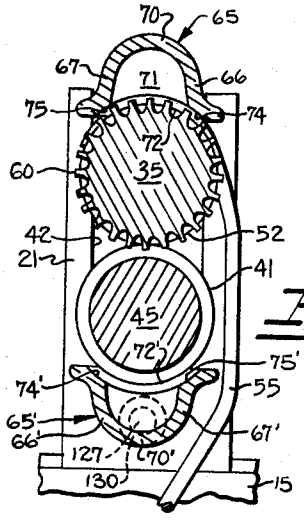


Fig-7

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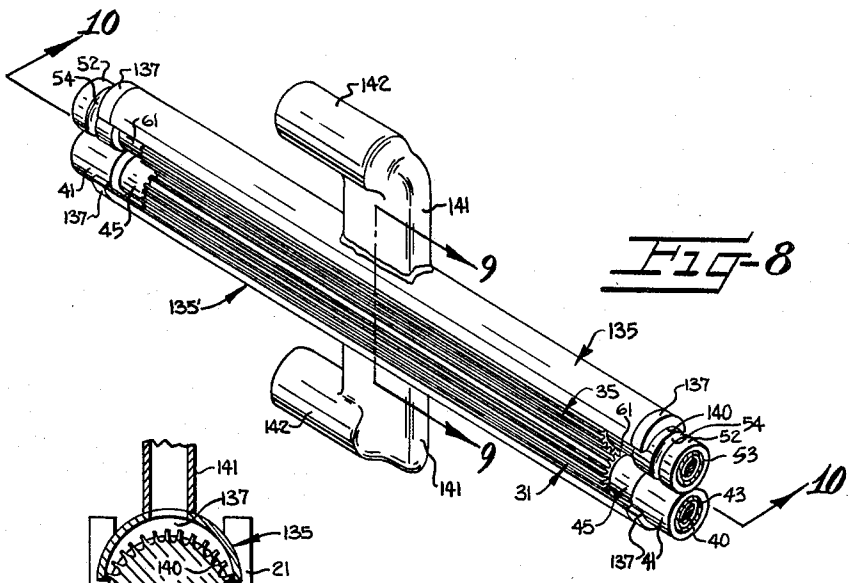


Fig-8

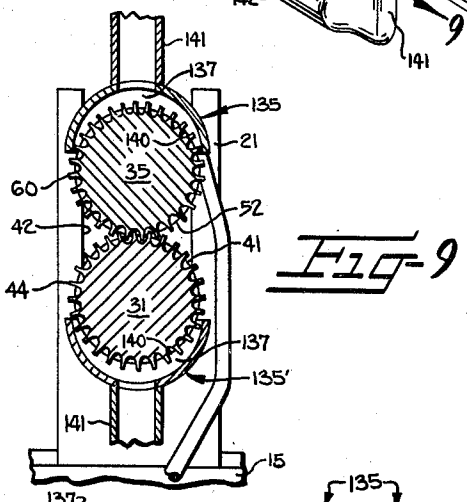


Fig-9

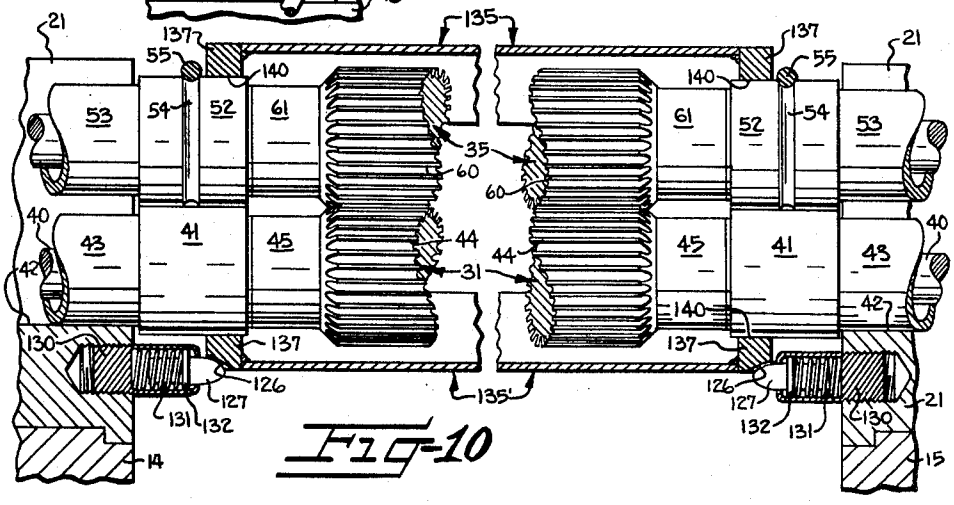


Fig-10

United States Patent Office 2,935,435 Patented May 3, 1960

2,935,435

METHOD OF INCREASING FIBER LENGTH WHILE DRAFTING

Marcus G. Whitehurst and Joe R. Whitehurst, Bessemer City, N.C., assignors to Ideal Industries, Inc., Bessemer City, N.C., a corporation of North Carolina

Application July 3, 1958, Serial No. 746,452

7 Claims. (Cl. 19—130)

This invention generally relates to the art of drafting or attenuating textile fibers and it is the primary object of this invention to provide a novel method of drafting textile fibers such as to increase the average staple length of textile fibers.

This application is a continuation-in-part of our co-pending application, Serial Number 656,247, filed May 1, 1957, and entitled Suction Clearer for Textile Rolls and Method.

One of the important functions of a comber is to remove fly and extremely short fibers from textile tow or web material; that is, fibers up to approximately five-eighths inch long are separated and removed from fibers of greater staple length so that the average staple length of the fibers, considered collectively, is considerably increased. It follows, therefore, that the removal of short non-spinnable fibers from the fibrous textile material during the drafting thereof effects an average increase in staple length with a resultant higher grade tow or sliver of increased strength and improved texture.

In order to remove the short non-spinnable fibers from the strands of carded stock as they are drafted on a drawing frame, the present method involves substantially confining a substantial portion of the periphery of each individual drafting roll throughout at least its working surface, or throughout its entire length, and moving relatively high velocity air suction currents or other high velocity gaseous stream substantially longitudinally of each roll within the confined area, and then generally radially outwardly away from the confined area, while permitting only the extremely small fiber particles adhering to each roll to pass into the confined area. Thus, as these short, fine fiber particles move into the confined area, the suction currents, being generally perpendicular to the path at whch the fibers are originally caused to adhere to the rolls, will remove such fiber particles from the rolls and cause the same to be drawn away from the rolls. This causes a substantially increased amount of waste fibers per given amount of fibers being processed, but this increased waste comprises only the short non-spinnable fibers. By confining the individual drafting rolls according to the present method, it has been found that up to 60 percent more waste is removed from the tow or sliver than has been the case in utilizing so-called clearer boards and suction clearer devices which were incapable of confining rolls and causing air to flow in the manner described.

It is another object of this invention to provide a novel method which enables continuously operating the drafting rolls of a drawing frame or the like at substantially higher speeds than have heretofore been attainable. The method includes confining a substantial portion of the periphery of each drafting roll throughout its length as well as a substantial portion of the bearings and roller necks adjacent opposite ends of each drafting roll while creating suction currents within the confined area so that air is caused to flow past the bearings and through the confined area generally longitudinally of the rolls. Thus, the bearings, as well as the rolls, are maintained relatively

cool and the heat created by the high speed operation of the drafting rolls and the fibrous material passing therebetween is dissipated. Prior to our novel method of maintaining cool the bearings and drafting rolls of a drawing frame, such rolls could be driven for extended periods at speeds of less than 200 feet per minute. Prior attempts have been made to operate the rolls at a speed of 250 feet per minute, but this could only be done for very limited periods due to overheating of the rolls and bearings. Experiments utilizing the present method have proved that the drafting rolls may be operated at surface speeds of up to at least 600 feet per minute, and the present method will permit speeds far above 600 feet per minute.

The rubber or other cots of cushion drafting rolls would normally deteriorate very rapidly at speeds which can now be maintained by utilization of our novel method of cooling the rolls. Prior to our improved method, the usual steel fluted rolls could not be run continuously at speeds in excess of approximately 200 feet per minute because the rolls would become heated to such temperature that they would scorch the fibers or would even cause a fish fire, notwithstanding the fact that they could not be touched by the operator without burning the operator.

To enable a clear understanding of this phenomenon, consider that textile fibers are normally drafted by pulling fibers relative to each other to parallelize the fibers, increase the length of the body formed of the fibers and reduce the diameter of the body. This is effected by passing the body, which is commonly in rope form (sliver or roving), between successive pairs of drafting rolls driven at progressively increasing speeds from the rear pair to the front pair of rolls and which are spaced apart distances greater than the length of staple being processed. The pairs of rolls are also normally spaced apart progressively increasing distances from the rear pair to the front pair.

Now, when the speeds of all the fluted drafting rolls are proportionately increased in accordance with this invention, it will be understood that, as the fibers proceed from one pair of rolls to the next pair of rolls to be drafted therebetween, the leading ends of individual fibers, upon being engaged by the leading pair of rolls, are momentarily grasped and a sudden pulling force is exerted thereon while, at the same time, the trailing ends of the fibers will be tightly gripped by the surrounding adjacent fibers to such extent that the individual fibers themselves engaged by the leading rolls will be elongated. It is apparent that the elongation of individual fibers, in many instances, is determined by the extent to which a particular fiber or groups of fibers are intermingled with adjacent fibers, since the gripping force on the leading ends of individual fibers, while the leading end is engaged by drafting rolls, determines the amount of holding force applied to the fibers and in turn, of course, controls the amount of elongation imparted to the fibers due to the stress applied to the fibers. Thus, the greater the speed of the drafting rolls, the more sudden the pulling force effected between adjacent fibers and the greater the stress to which the fibers are subjected, with consequent greater stretch (greater length) being imparted to individual staples. This can be more fully comprehended when it is realized that less force is required to slowly pull apart a pair of loosely twisted strands than is required to rapidly pull these same strands apart.

It has also been discovered that the greater the speed at which sets of fluted drafting rolls are operated, the greater may be the distance between adjacent sets or pairs of drafting rolls for a given length of staple, since the staple length is increased somewhat proportional to the increase in speed of the drafting rolls; i.e., the quicker

or more sudden the pulling of fibrous stock by sucessive rolls from between preceding rolls, the greater the resistance to the pulling force created by the interconnected fibers between adjacent pairs of rolls, so that the individual staples are actually stretched and remain extended when fluted top and bottom drafting rolls are used.

It is therefore another object of this invention to provide a method of increasing staple length which includes moving currents of air past the drafting rolls and the bearings to cool the same while causing the currents of air to flow within a confined area extending longitudinally of the fluted drafting rolls, and while operating the drafting rolls at a speed of from 200 to at least 600 feet per minute with a displacement between adjacent rolls substantially exceeding the length of staple.

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 top plan view of an improved clearer apparatus applied to a drawing frame, with portions of the drawing frame and the apparatus broken away, the clearer being particularly adapted for carrying out the present method;

Figure 2 is an enlarged longitudinal vertical sectional view, mostly in elevation and with parts broken away, and being taken substantially along line **2—2** in Figure 1;

Figure 3 is an enlarged transverse vertical sectional view taken substantially along line **3—3** in Figure 2;

Figure 4 is an enlarged fragmentary longitudinal vertical sectional view taken substantially along line **4—4** in Figure 3 and showing, in particular, how opposed ends of the upper and lower suction heads bear against corresponding bearing members;

Figure 5 is an inverted sectional plan view looking upwardly substantially along line **5—5** in Figure 2;

Figure 6 is an isometric view showing a pair of top and bottom rolls with portions of the bearing members in which opposite ends thereof are journaled, and showing the corresponding suction heads cooperating therewith;

Figure 7 is a fragmentary transverse vertical sectional view taken substantially along line **7—7** in Figure 4;

Figure 8 is an isometric view similar to Figure 6 showing a modified form of suction head;

Figure 9 is a transverse vertical sectional view taken substantially along line **9—9** in Figures 8;

Figure 10 is an enlarged longitudinal vertical sectional view taken substantially along line **10—10** in Figure 8; the central portion being broken away, and showing portions of corresponding roll stands associated therewith.

The present method is carried out by means of an improved clearing apparatus which is shown in association with a textile drawing frame in the annexed drawings, although it is to be understood that the improved clearer apparatus may be used in association with any type of textile machine having rolls for attenuating or drafting fibrous strands, such as a spinning frame, roving frame or the like. Also, the drawing frame shown herein is provided with four sets of top and bottom drafting rolls in each roll section, but it is to be understood that a greater or lesser number of drafting rolls may be employed and that all the drafting rolls need not be of the fluted type.

Referring more specifically to the drawings, the numeral **10** broadly designates the main frame of the drawing frame or machine. The frame **10** comprises a head-end frame member **11** which contains conventional driving mechanism, not shown, and which supports one end of a beam **12** on which a plurality of longitudinally spaced roll stand supports are mounted, there being four such roll stand supports shown in Figures 1 and 2 indicated at **13, 14, 15** and **16**. The beam **12** is also supported by a foot-end frame member **17**. The rear side of the machine appears in the lower portion of Figure 1 and is shown partially in section in Figure 2, wherein it will be observed that the rear portions of the roll stand supports **13** through **16** support a platform **20** (see also Figure 3).

The forward portions of the roll stands **13** through **16** each supports a plurality of substantially U-shaped bearing blocks or roll stands **21** which roll stands support a plurality of roll series or sections, there being four such roll sections shown in Figure 1 generally designated at A, B, C and D, the proximal portions of the roll sections C, D being broken away.

The roll stand supports **13** and **16** (Figure 2) may be termed as head-end or foot-end supports and the roll stand supports **14** and **15** may be termed as intermediate roll stand supports. In this instance, each of the roll sections A, B, C, D includes four pairs of serially arranged top and bottom rolls, all of which are shown as being fluted rolls in Figures 2, 3, 4, 6 and 7. However, as is well known, many drawing frames are equipped with so-called cushion top rolls which have resilient cots thereon made from neoprene, rubber, leather or other compositions. The present method improves the tow or sliver formed with either type of top roll as well as facilitating substantially higher speed operation thereof than has heretofore been practicable.

The bottom rolls in each series or section are indicated at **31** through **34**, inclusive, reading from the rear of the machine forwardly, and the top rolls or weight rolls of each section are indicated at **35** through **38**, inclusive. The bottom rolls in each section are connected with the coresponding axially alined bottom rolls of the next adjacent section by means of roller necks or reduced portions **40** (Figure 4) which are journaled in tubular bearing members **41** having reduced medial portions **43** positioned upon the bottom of substantially U-shaped grooves **42** formed in the corresponding intermediate roll stands **21**. As is well known, some drawing frames are devoid of bearing members for the roller necks of the bottom rolls, such roller necks then being journaled on the bottoms of the grooves **42**. However, the lower suction heads herein are readily adaptable for use on the latter type drawing frames.

Enlarged opposite ends of each bearing member **41** are preferably of substantially the same diameter as the pitch diameter of the fluted portions **44** of the corresponding bottom rolls. Each of the bottom rolls is provided with a reduced portion **45** disposed between the fluted portion or boss **44** thereof and the enlarged end of the corresponding bearing member **41** (Figures 4 and 6).

The distal ends of the bottom rolls in sections A, D are mounted in respective roll stands or bearing blocks **21*a***, **21*b*** in substantially the same manner in which the proximal ends of adjacent bottom rolls are mounted in the intermediate roll stands **21** as heretofore described. Corresponding reduced ends of the bottom rolls in section A extend into the head member **11** and are driven at progressively increasing speeds from the rear to the front in a well known manner.

As is usual, the top rolls in each roll section are separate from the top rolls of the adjacent section or sections, and each end of each top roll has a reduced journal portion integral therewith which is journaled in a bearing member **52** having a reduced portion **53** guided for vertical sliding movement in a corresponding bearing block **21**, **21*a*** or **21*b***, as the case may be. As best shown in Figure 4, the enlarged end of each bearing member **52** is disposed outwardly of the corresponding roll stand and each of these enlarged portions is provided with a peripheral groove **54** for receiving the hooked upper end of a corresponding weight link **55**.

The lower end of each of the links **55** has a suitable weighting means connected thereto which is embodied in a weight member **56** connected to the corresponding link by means of a weight arm **57**. Each of the top rolls

is also provided with an enlarged portion forming a working surface, which enlarged portion may be in the form of a cot, although it is illustrated as an enlarged fluted portion 60 spaced from the enlarged portion of the corresponding bearing member 52 by an intermediate reduced or roller neck portion 61. In the instance of fluted top rolls being used, the enlarged portion of each bearing member 52 is also preferably of a diameter substantially the same as the pitch diameter of the fluted portions 60 of the corresponding rolls. Of course, in the event of the top rolls being in the form of cushion rolls; that is, with a smooth face bosses or cots being provided on the top rolls, the diameter of the enlarged ends of bearing members 52 need only be less than the diameter of the boss portions 60.

The parts heretofore described are conventional parts of a drawing frame and it is with such or similar parts that the present invention is adapted to be associated, it being well known that the roll stands 21, 21*a* and 21*b* are adjustably mounted on the corresponding roll stand supports 13, 14, 15 and 16 in a conventional manner to permit adjustment of the rolls in each section relative to each other, depending upon the length of the fibers in the material being processed and the speed of the rolls.

In carrying out the present method a confining means is provided for partially confining each of the textile rolls 31 through 38 in each section A, B, C, D. All the confining means of the first form of the invention shown in Figures 1 through 7 are substantially identical and are shown in the form of elongated housings, nozzles or suction heads. The suction head associated with each of the top rolls is broadly designated at 65 and the suction head associated with each of the bottom rolls is broadly designated at 65'. Since the bottom suction heads 65' are substantially the same as the top suction heads 65, only the top suction heads 65 will be described in detail and like parts associated with the bottom suction heads 65' will bear the same reference characters with the prime notation added.

Each of the suction heads 65 is open or slotted throughout the length of the portion thereof adjacent the corresponding roll and includes opposed longitudinally extending side walls 66, 67 whose upper portions are connected together by a curved upper wall 70 preferably formed integral with the side walls 66, 67. The side walls 66, 67 and corresponding portions of the top wall extend upwardly in converging relationship from opposite ends of the suction head 65 so as to provide a greater air capacity at the center of each suction head 65 as compared to the opposite end portions thereof.

Opposite ends of each suction head 65 are at least partially closed by closure end members which may be formed integral with the side and top walls 66, 67, 70 and 71 whose lower edges are each provided with a curved surface or arcuate cavity 72 of a radius substantially conforming to the radius of the enlarged portion of the corresponding bearing member 52 so the suction head 65 may be supported upon the enlarged portions of corresponding bearing members 52 in accurate relation to the fluted or boss portions 60 of corresponding top rolls. It is particularly desirable that the distance between the opposed side walls 66, 67, at the lower edges thereof, does not exceed the outside diameter of the fluted portion 60 and is preferably substantially less than the outside diameter of the fluted portion 60 as shown in Figure 7 so the lower edges of the walls 66, 67 of each suction head 65 may be provided with arcuate surfaces 74, 75 thereon which are formed substantially concentric with the arcuate surfaces 72 formed in the end closure members 71, but which are of a radius substantially equal to or slightly greater than the radius of the external surfaces of the ridges formed by the flutes 60 of the corresponding top rolls.

It has been found desirable to provide a clearance between the edges 74, 75 of the respective side walls 66, 67 and the cylindrical or exterior surface of the corresponding top rolls of from five-ten-thousandths of an inch to five-thousandths of an inch in order to minimize leakage of air between said edges 74, 75 and the periphery of the corresponding top roll. In other words, the displacement between the surfaces 74, 75 of the respective side walls 66, 67 of each suction head 65 and the periphery of the corresponding roll should be held to a minimum, just so long as the surfaces 74, 75 do not contact the periphery of the corresponding roll.

One way in which the surfaces 74, 75 may be formed concentric with the surfaces 72 on the end closure member 71, and so the surfaces 74, 75 may be accurately spaced from the periphery of the corresponding roll when installed, is to move the open end of the corresponding suction head 65 into engagement with an abrading tool, reamer or other cutting tool having opposite end portions thereof of a diameter equal to the diameter of the enlarged portions of the bearing members 52 and having an enlarged medial portion of a diameter slightly greater than the diameter of the roll adjacent which the corresponding suction head 65 is to be installed.

The outer end of each suction head; that is, the upper end of each suction head 65 and the lower end of each suction head 65' has an air passageway therein. To this end, the top wall 70 of each top suction head 65 has a hollow neck or projection 80 communicatively connected to the central portion thereof, which hollow projection 80 has a round tubular extension 81 integral therewith and extending substantially parallel to the general longitudinal axis of the suction head 65 and the corresponding top roll. Of course, each lower suction head 65' is provided with a hollow neck 80' and a tubular extension 81' which are identical to the hollow neck 80 and tubular extension 81 of the upper suction head 65.

Although it is desirable that the proximal surfaces of the lower edges of the walls 66, 67 of each suction head 65 are spaced a lesser distance apart than the diameter of the enlarged portion of the corresponding roll, as stated above, it is contemplated that the distance between the lower edges of the walls 66, 67 may be slightly greater than the diameter of the enlarged portion of the corresponding roll and may then terminate on a level substantially the same as the level of the longitudinal axis of the corresponding roll. However, the suction head 65 may be more readily machined to provide the desired clearance between the walls of the hood or suction head and the periphery of the enlarged portion of the corresponding roll by initially forming the lower edges of the walls 66, 67 of each suction head 65 at lesser distance therebetween than the diameter of the corresponding portion of the corresponding roll.

Now, referring especially to Figures 1 and 3 it will be observed that the open ends of the tubular projections 81 of the suction heads 65 each face in the opposite direction from the opening in the tubular portion 81 of the adjacent suction head 65 in the same roll section. In other words, the air exhaust openings in the tubular projections 81 face in opposite directions in alternation. While this may not be entirely necessary, it is desirable due to the necessary close proximity of adjacent top and bottom rolls, since each of the tubular projections 81 has a pliable or flexible conduit 82 connected thereto which, for the sake of convenience, is preferably of greater external diameter than the diameter of the top and bottom rolls in each section.

It will be observed in Figures 1, 2 and 3 that each of the sets of bearing blocks or roll stands 21, 21*a*, 21*b* has an elongated hollow header or manifold overlying the same, the manifolds disposed above the respective roll stand supports 13, 14, 15 and 16 being indicated at 83, 84, 85 and 86. The manifolds 83 through 86 may be secured to the corresponding sets of roll stands 21, 21*a*, 21*b*, but are preferably spaced therefrom or rest lightly upon the same in order to permit the roll stands in each

set to be adjusted relative to each other. Thus, it will be observed that the manifolds 83 through 86 extend rearwardly of the corresponding roll stands and are attached to the upper ends of respective posts or standards 87 whose lower ends rest upon and are suitably secured to the plate 20.

Referring again to Figures 1 and 2, it will be observed that the conduits 82 extending from the first and third suction heads 65 above the roll section A are communicatively connected to the head-end manifold 83 while the conduits 82 extending from the second and fourth suction heads 65 in the roll section A are communicatively connected to corresponding sides of the intermediate manifold 84. The conduits 82 extending from the first and third suction heads 65 above the roll section B are communicatively connected to the opposite side of the intermediate manifold 84 from that side to which the two conduits 82 from the roll section A are connected, while the second and fourth conduits 82 extending from the suction heads 65 and the roll section B are communicatively connected to corresponding sides of the second intermediate manifold 85, the conduits 82 in the roll sections C and D also being similarly arranged.

As best shown in Figures 2 and 3, the rear portions of the manifolds 83 through 86 have respective elbow pipe fittings 93 through 96 communicatively connected thereto which are connected to rigid substantially vertical conduits or pipes 100 through 103, respectively, by means of relatively short flexible or pliable tubes or conduits 105 through 108, respectively. The lower ends of the rigid conduits 100 through 103 are communicatively connected to a common substantially horizontal main duct 111 which extends substantially throughout the length of the combined roll sections A, B, C and D and may be suitably secured to the beam 12 of the frame 10. To this end, the beam 12 is provided with a plurality of rearwardly extending projections 112, only one of which is shown in Figure 3.

Each of the projections 112 has a concave outer surface 113 in which the corresponding portion of the main duct 111 is seated, the main duct 111 being held against each block or projection 112 by means of a substantially C-shaped strap member 114 whose rear ends are suitably secured to the upper and lower ends of the corresponding projection 112. Opposite ends of the main duct 111 are closed, preferably by means of removable closure caps 115.

A conduit 120 is communicatively connected to a medial portion of, and depends from, the main duct 111, the other end of the conduit 120 being connected to a suitable source of suction, not shown. The conduit 120 may be connected to the usual vacuum system provided in most textile mills for directing lint, other fibers and foreign matter to a common place in the mill.

It is evident that an individual collecting and suction means or blower may be associated with a pipe or conduit 120 associated with each drawing frame, spinning frame or the like, and will induce vacuum currents in the main duct 111 and will thereby withdraw excess lint, fibers and other foreign matter, removed from the top and bottom rolls of each roll section into a common receptacle disposed adjacent to or remote from the drawing frame.

As heretofore stated, the lower suction heads 65' are substantially the same as the upper suction heads 65 and, as best shown in Figure 5, the flexible or pliable conduits 82' of each roll section extend outwardly in opposite directions in alternation from the respective tubular extensions 81'. Alternate flexible conduits 82' are communicatively connected to a manifold 122 and the other flexible conduits 82' associated with the same roll section are connected to a manifold 123. Thus, a pair of manifolds 122, 123 is provided between each adjacent pair of roll stand supports and extends substantially parallel to the roll stand supports.

It will be observed in Figure 2 that the rear ends of the lower right-hand manifolds 123 are connected to the respective rigid conduits 101, 102 and 103. The left-hand lower manifold 122 in roll section A (Figure 2) is the only one of the manifolds 122 connected to one of the rigid conduits communicating with an upper manifold, this manifold 122 being connected to the upright conduit 100. The remaining manifolds 122 merely extend rearwardly and then curve downwardly and are communicatively connected to the main duct 111.

In order to assist in supporting the main duct 111 and to also maintain each of the manifolds 122, 123 in proper position adjacent the corresponding roll stand supports, each lower manifold 122, 123 is clampingly secured in a substantially C-shaped bracket 125 whose free ends are urged together by a screw 128 (Figure 3). Each C-shaped clamp member 125 is suitable secured to or integral with a standard 129 suitably secured to the upper surface of the beam 12 of the frame 10.

Any suitable means may be provided for releasably maintaining the closure means 71' at opposite ends of each lower suction head 65' in engagement with the corresponding enlarged portions of the bearing members 41. In this instance, it will be observed in Figure 4 that each closure end portion 71' is provided with a groove or notch 126 therein which is adapted to be engaged by the rounded free end of a spring-loaded plunger or detent 127 guided for substantially horizontal movement in a housing 130 threaded into a lower portion of a corresponding roll stand. The plunger or detent 127 is normally urged outwardly by a compression spring 131 which bears against a shoulder 132 formed on the plunger 127.

As heretofore stated, the edges of the side walls 66, 67 and 66', 67' of the respective suction heads 65, 65' are disposed in such close proximity to the peripheries of enlarged fluted or boss portions 60 and 44 of the corresponding rolls as to substantially prevent passage of air therebetween. However, since the opposite ends of each suction head extend beyond opposite ends of the enlarged portion or boss of the corresponding drafting roll, this provides an air ingress opening at opposite ends of each suction head adjacent the corresponding roller neck or bearing member. Since air is drawn from each of the suction heads 65, 65' at its central portion and away from the edges of the side walls thereof disposed adjacent the corresponding textile or drafting roll, the air is drawn through the openings defined between the enlarged portions of the rolls and the bearing members and flows generally longitudinally of the enlarged fluted or boss portion of the corresponding roll.

Now, it will be noted that the latter openings defined between the enlarged portions of the rolls and the bearing members are relatively small and are so formed as to insure rapid flow of air about the roller necks or reduced portions 45, 61 of the rolls and past the inner portions of the respective bearing members 41 and 52. In so doing, the compressed air insures that the bearing seals, usually provided on the inner faces of the bearings, are maintained clean; that is, fly, lint and the like will not collect on the bearing seals, which, in itself, is important to permit continuous high-speed operation. In addition, the flow of air past the bearings and the reduced portions of the rolls, as well as longitudinally thereof, maintains the rolls and the bearings cool, to such an extent that the rolls can be operated at much higher speeds, than have heretofore been possible, for unlimited periods of time without becoming overheated.

As heretofore stated, overheating of the drafting rolls and bearings has been the primary deterrent to operating drafting rolls at high speeds. For example, it has not been practical heretofore to operate drafting rolls in which the delivery roll speed was 250 feet per minute. Speeds somewhat slightly above 250 feet per minute have been attempted, but the machine could not be run for any

appreciable length of time without the drafting rolls, roller necks and bearings becoming prohibitively overheated. By using the present method of cooling the rolls and bearings, we have found that the delivery rolls operate satisfactorily at surface speeds in excess of 600 feet per minute whereas, heretofore, the average operating surface speed for delivery rolls one and one-eighth inches in diameter has been approximately 142 feet per minute. It is contemplated that delivery rolls of a drawing frame may be operated at speeds substantially above 600 feet per minute, but present experiments have been made using speeds only slightly above 600 feet per minute. It is apparent that, since the delivery of front rolls are operated at speeds in excess of 600 feet per minute, the remaining rolls of each section operate at progressively increasing speeds from the rear to the front sets of rolls.

As the air is drawn into the openings past the roller necks, the air also moves generally transversely to the fibers being processed; that is, lengthwise of the rolls and, since the fibers accumulate in the flutes of fluted rolls to a greater extent than they normally do on the outer surfaces of the ridges formed by the flutes, the air moves generally parallel to the flutes and has a "raking" effect on any fibers tending to accumulate in the flutes of the rolls. The slight clearance between the edges of the suction heads and the respective rolls or cots and/or fluted portions of the rolls is such as to permit extremely small hair-like fibers to pass therebetween and, due to the air passing through a confined area past each roll, this causes the air to move quite rapidly or at relatively high velocity to insure that the finest possible fibers are removed from the peripheries of the rolls by the air flowing through the suction heads, the fibers being drawn from the rolls and exhausted to the collection and suction device.

The area through which the air is drawn into each suction head 65, 65' is so small relative to the over-all length and width of the longitudinal slots in the proximal ends of the upper and lower suction heads 65, 65' that it has been found that the suction heads may be maintained in engagement with the enlarged portions of the corresponding bearing members solely by the suction created within the suction heads 65, 65'. However, the restraining means shown in the lower right-hand portion of Figure 4 is provided at each lower suction head 65' in order to maintain the heads 65' in proper position when the machine is not operating.

Opposite ends of the upper suction heads 65 may extend outwardly and be provided with a groove similar to the groove 54 shown in the enlarged portion 53 of the bearing member 52, if desired, and the hooked upper portions of the corresponding weight links 55 may be positioned upon the corresponding ends of the suction heads 65. However, it sometimes happens that small quantities of a sticky tar-like substance is present in the fibers being processed. From time to time, this substance will adhere to the peripheries of the boss portions or fluted portions of the rolls to such extent that such accumulations will engage the proximal surfaces of the side walls 66, 67 and 66', 67' of the respective suction heads 65, 65' and cause the corresponding suction heads 65 and/or 65' to move away from corresponding textile rolls. It is apparent that this will cause either or both of the opposite end portions of the corresponding suction heads to move away from the bearing members momentarily or until the tar-like substance is removed from the rolls.

It is apparent that, if the top and bottom suction heads 65, 65' were restrained from moving away from the rolls under the latter conditions, the rolls and/or the corresponding suction heads might become damaged. Since each detent 127 is yieldable, it is apparent that this would permit corresponding ends of the lower suction head 65' to move away from the enlarged portion 43 of the corresponding bearing member 41 without becoming entirely disengaged from the detents 127.

It might be stated that, although the displacement between the outer surfaces of the ridges formed by the flutes in the top and bottom rolls shown in the drawings and the corresponding edges of the side walls of the corresponding suction heads 65, 65' is relatively slight, this is still sufficient to permit fine fly, lint and the like, to pass therebetween. In the event that it will not pass therebetween, the fly, lint or the like merely rolls into the adjacent flutes (in the instance of fluted rolls) and is then withdrawn therefrom as each flute passes within the confinement of the corresponding suction head. In the instance of smooth-faced boss portions on the textile rolls, if may be desirable to increase the clearance between the edges of the side walls of the corresponding suction heads and the boss portions of the rolls to avoid an excessive build-up of fibers between the front edges of suction heads 65, 65' and the corresponding rolls. However, it has been found that this clearance need not necessarily exceed ten-thousandths of an inch.

In Figures 8, 9 and 10, a modified form of apparatus for carrying out the present method is shown wherein upper and lower suction heads are respectively broadly designated at 135 and 135'. These suction heads 135, 135' are quite similar to the first forms of suction heads 65, 65' with the primary exception that the body of each of the suction heads 135, 135' is of the same depth throughout the length thereof so the suction heads are substantially segmentally circular or semi-circular in cross-section. The radius of the body portion of each of the suction heads 135, 135' is preferably less than the radius of the boss portion or fluted portion of the corresponding rolls so that the distance between opposite edges thereof is less than the diameter of the boss or fluted portions of the rolls. Of course, the body portions may extend through an arc greater than 180° and then be of greater radius than the rolls, just so long as opposed edges of the body portion are spaced close enough together to be located very close to the boss or fluted portion.

Like the first form of suction head, each end of the substantially semi-circular suction heads 135, 135' has a closure member 137 thereon provided with an arcuate inner surface 140 for engaging a corresponding bearing member, the conventional parts of the machine shown in Figures 8 and 9 having the same reference characters as the corresponding parts shown in Figures 1 through 7. A medial portion of each of the suction heads 135, 135' has a hollow neck portion 141 communicatively connected to or formed integral therewith which is provided with a tubular extension 142 corresponding to the tubular extensions 81 and 81' of the first form of the invention.

As is the case in the first form of the invention, the lower or opposite edges of the suction heads 135, 135' are each arranged concentric with the surfaces 140 of the end closure members 137 and are formed about a radius slightly greater than the radius of the corresponding rolls so as to provide from five-ten-thousandths to ten-thousandths of an inch clearance between the edges of the suction heads 135, 135' and the corresponding textile rolls.

The suction heads 135, 135' function in exactly the same manner as the suction heads 65, 65' and a further detailed illustration and description thereof are thus deemed unnecessary. Like parts in Figures 4 and 10 shall bear the same reference characters, except as noted above, to avoid repetitive description. It is apparent that notches 126 are formed in the lower suction head ends 137 (Figure 10) corresponding to the notches 126 in the closure members 71 (Figure 4).

It is thus seen that we have provided a novel method of drafting fibrous textile material resulting in increased production and a higher grade sliver or tow in which a gaseous stream or currents of air are moved past the

rolls and the bearings at high velocity to maintain cool the bearings and the rolls and wherein the currents of air move longitudinally of the rolls; i.e., parallel to the axis of each roll and in confined area closely adjacent each individual roll and then move radially outwardly away from each roll so as to remove small hair-like fibers, fly and lint from the rolls to thereby produce an increased average fiber length as the textile material is attenuated or drafted, regardless of whether fluted rolls or cushion rolls and/or fluted rolls are used. Further, it is seen that we have provided a novel method including operating sets of fluted drafting rolls at high speeds such that the receiving sets of rolls cause a sudden pulling of the fibers from the preceding or delivery rolls, which sudden pulling of the fibers causes the fibers between the adjacent pairs of rolls to more tightly grasp each other or cling together with a consequent stretching of the individual fibers so that, not only are the fibers attenuated collectively, but the length of the individual fibers is also increased.

It might be stated that the reason why the present method results in greater average staple length when applied with respect to either fluted drafting rolls or fluted and/or cushion rolls, is that the particular manner of controlling the direction of flow of the air currents and the high velocity thereof removes a substantially greater amount of waste non-spinnable fibers from the textile material being processed through the successive pairs of drafting rolls than has been possible with prior methods. Although prior methods might effect the removal of large amounts of fibrous material from the sliver being drafted, such material would include spinnable fibers which should not be removed from the sliver and would not result in any noticeable increase in average staple length.

In drafting fibrous textile material at delivery roll surface speeds of up to approximately 200 feet per minute, as has been the case prior to our improved method, the spacing of the rolls has been 1¼"–1½"–1¾"; that is, the center to center distance between the top rolls **35** and **36** in Figure 3 has been 1¼", the center to center distance between the rolls **36** and **37** has been 1½" and the center to center distance between the rolls **37** and **38** has been 1¾", for example, and the increase in the length of individual fibers has been negligible. In processing textile fibers; such as cotton, having a one-inch staple, the average staple length was only increased to 1$\frac{1}{32}$".

Increasing the speed of the delivery rolls, according to the present method, up to 400 feet per minute has required that the roll spacing be increased to 1$\frac{5}{16}$"–1$\frac{9}{16}$"–1 1$\frac{3}{16}$", with a resultant increase in average staple length of $\frac{1}{16}$ of an inch (approximately 6¼%) in a one-inch staple cotton material. As a further example, increasing the surface speed of the delivery rolls to 500 feet per minute has required that the roll spacing be 1⅜"–1⅝"–1⅞" with a resultant increase of $\frac{3}{16}$ of an inch (approximately 18½%) in the average length of staple of a material which had one-inch average staple length as it was fed to the delivery rolls. Average staple lengths have been increased as much as ¼ inch (25%) in practicing the present method. From the foregoing, it is apparent that a high grade tow or sliver can thus be obtained through processing a relatively low grade cotton, for example, according to the present method. It should be noted that, with increased speeds of the delivery rolls **31**, **35**, the speeds of the subsequent pairs of fluted rolls are progressively increased, since the progressively increased length of individual fibers requires a greater draft of the body of fibers being processed.

It is important to note that a separate suction head **65**, **65'** is provided for each individual drafting roll and a closely confined area is formed at the periphery of each drafting roll by the confining walls of the respective suction head, the confining walls being positioned in close proximity to the boss, cot or fluted portion of the rolls and extending beyond the ends of the latter portions of rolls to thereby draw air past the bearings and roller necks for cooling the same, and to cause the air to flow through the suction heads in directions substantially parallel to the longitudinal axes of the respective rolls. The flexible tubes or conduits **82**, **82'** permit relative movement between the suction heads and the corresponding manifolds and also facilitate removing the suction heads for replacement of corresponding rolls or for removing any accumulations of tar-like substance which may adhere to any of the rolls, as well as permitting adjustment of each set of rolls in each section relative to the other sets of rolls.

The present method is applicable to the processing of natural or cellulosic fibers; such as cotton and wool, staple synthetic fibers and blends of synthetic and natural staple fiber materials, as well as other textile fibers.

In the drawings and specifications 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.

We claim:

1. In a method of drafting textile material in rope form utilizing spaced pairs of driven drafting rolls mounted in bearings, the steps of directing, at relatively high velocity, a gaseous stream against and past the bearings of and parallel to the axis of each roll while confining the gaseous stream to a relatively narrow portion of the periphery of each roll to cool the bearings and rolls and to remove loose short fibers, lint and foreign matter from the rolls and the bearings.

2. In a method of drafting textile material utilizing fluted drafting rolls journaled in bearings, the steps of driving said rolls for periods of relatively long duration at surface speeds in excess of 200 feet per minute while directing air, at relatively high velocity, against the bearings and against the rolls and while causing the air to flow in a confined area longitudinally of the surface of each roll and remote from the path of the material passing between the rolls.

3. A method of drafting fibrous textile material on drawing frames having pairs of serially arranged fluted rolls mounted in bearings which comprises the steps of moving currents of air in a confined area longitudinally adjacent each of the fluted rolls to remove any waste in the confined area and in the flutes of the rolls and to cool the rolls and the bearings thereof, rotating the fluted rolls to deliver the textile material at a surface speed of at least 200 feet per minute, and attenuating the length of the individual fibers during their movement through the pairs of fluted rolls to thereby increase both the individual and the average staple length of the textile material.

4. The method of cooling bearings, roller necks and boss portions of textile drafting rolls on a drawing frame to enable high speed operation thereof which includes moving suction currents past the roller necks and bearings and along a confined path longitudinally of each of the rolls, generally parallel to the axis thereof, and then generally radially outwardly away from the rolls.

5. In a method for the production of long staple fibrous material, the steps of passing a continuous length of fibrous material through successive pairs of drafting rolls, and concomitantly directing a high velocity gaseous stream against journaled ends of each roll and in a substantially confined area parallel to the axis of and against the periphery of each roll to maintain cool the journaled ends and periphery of each roll while removing loose, short non-spinnable fibers from the rolls, the removal of the loose, short fibers serving to increase the average staple length of the fibers forming the bulk of the material.

6. In a method for the production of long staple fibrous material, the steps of passing a continuous length of fibrous material through successive pairs of drafting rolls,

while driving the rolls at relatively high speeds of 200 to at least 600 feet per minute and at progressively increasing speeds from the rear rolls to the front rolls, and concomitantly directing a high velocity gaseous stream against journaled ends of each roll and in a substantially confined area parallel to the axis of and against the periphery of each roll to maintain cool the journaled ends and periphery of each roll while removing loose, short non-spinnable fibers from the rolls, the high speed of the rolls causing fibers momentarily held at preceding rolls to place the rear ends of fibers grasped at succeeding rolls under such tension as to elongate individual fibers to increase individual staple length and the removal of the loose, short fibers combined with the increased individual staple length serving to increase the average staple length of the fibers forming the bulk of the material from 6¼% to 25%.

7. The method of increasing average staple length of fibrous cotton textile material on drawing machines having pairs of serially arranged fluted drafting rolls which includes operating the rolls at such high speeds as to cause a sudden stress to be placed on individual fibres of such extent as to elongate individual fibers while removing short non-spinnable fibers and thereby increasing the average staple length from 1/16 inch to ¼ inch in proportion to one inch original average staple length, and maintaining such speeds by cooling the rolls to dissipate the heat generated by the drafting of the fibrous material.

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