Oct. 31, 1939. H. LAMBERT 2,177,929

DRAFTING FRAME

Filed March 23, 1938 3 Sheets-Sheet 1

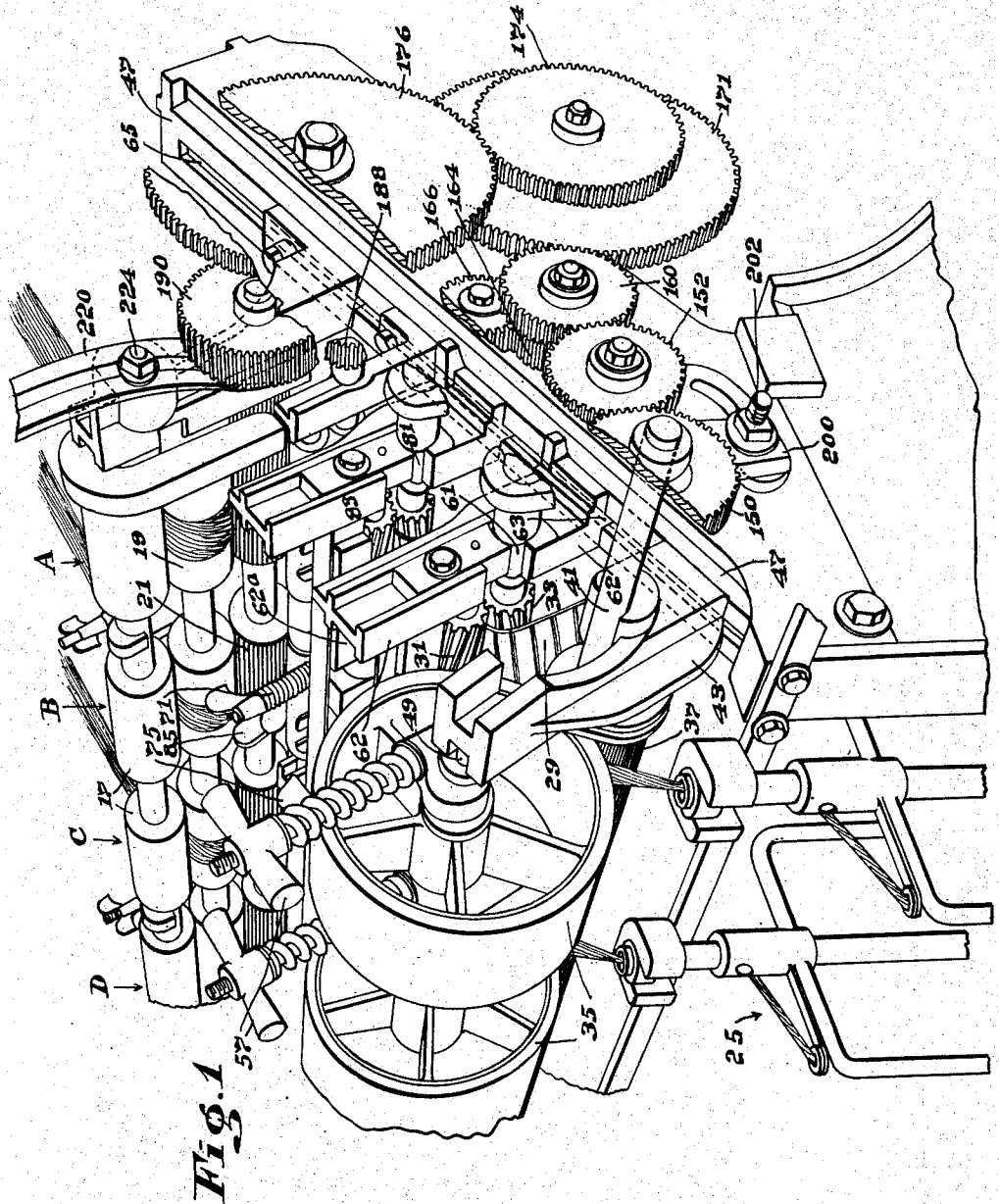


Fig. 1

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Filed March 23, 1938 3 Sheets-Sheet 2

Fig. 2

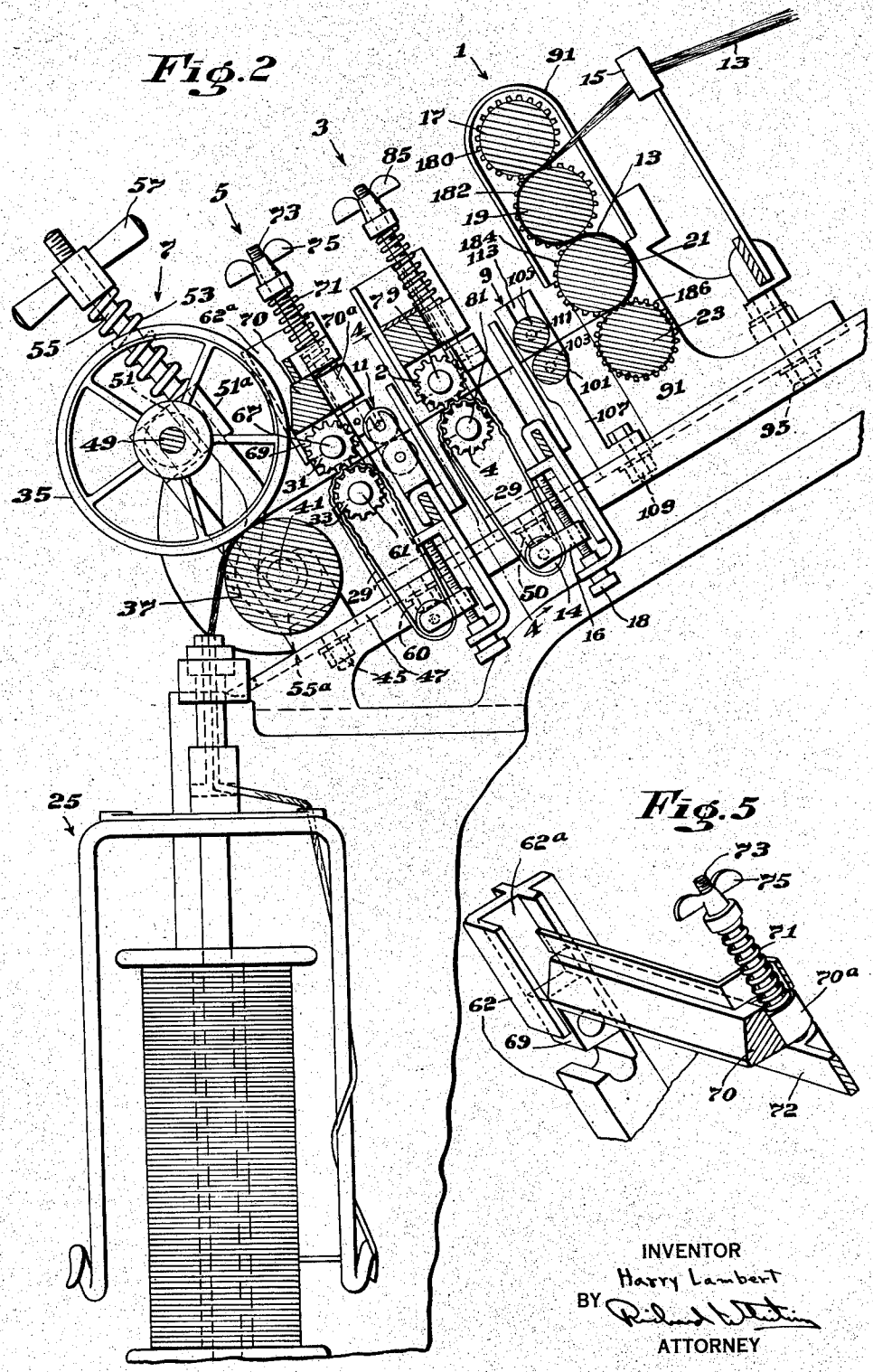


Fig. 5

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DRAFTING FRAME

Filed March 23, 1938 3 Sheets-Sheet 3

Fig. 3

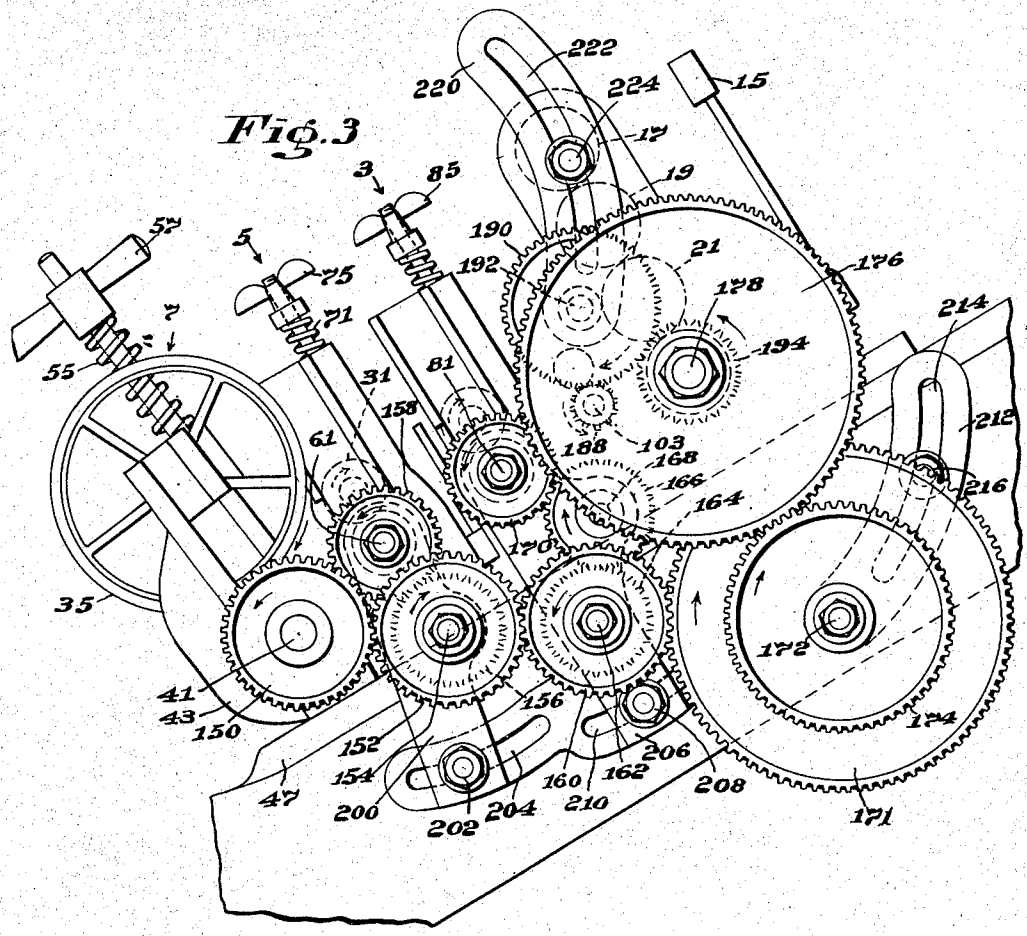
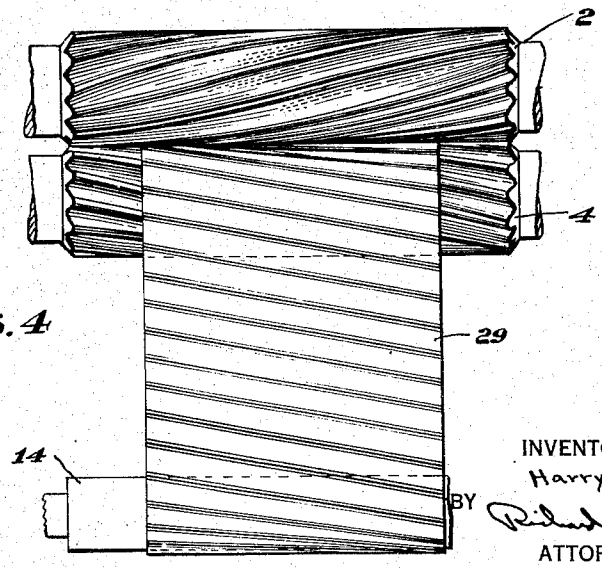


Fig. 4



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UNITED STATES PATENT OFFICE

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DRAFTING FRAME

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1 Claim. (Cl. 19—131)

This invention relates to drawing frames and particularly to a novel method and apparatus for effecting high, uniform, drafts, in one direction, of slivers, slubbing, rove and the like, preparatory to spinning.

Conventional drawing frames employ a number of sets of drafting rolls rotated at progressively increased speeds and spaced apart a distance exceeding the length of the longest fibre. An inherent unevenness in the material so drafted has led to the practice of doubling, which, in a degree, defeats the purpose of reduction in size, and where the fibres vary greatly in length, as in worsted, it has been necessary, in addition to such doubling, to reverse the direction of each successive draft so that the fibres can redistribute themselves whereby, in a measure, to restore uniformity in thickness.

The object of the present invention is to provide a high and uniform draft, particularly in material having wide variations in length of fibre, without such reversal to the end that several of the separate drafting operations heretofore employed in reducing the fibres preparatory to spinning may be effected on one machine which drafts the fibres repeatedly and successively in the same direction. My further purpose is to reduce, materially, the number of doublings required in the drafting operations.

My experiments have demonstrated that these objects may be attained by providing a more positive control and feed of the shorter fibres than has been afforded by prior drafting frames. To that end my novel frame embodies a number of sets of rolls, successively spaced apart by predetermined ratches, one or more of which ratches may be, and preferably is, shorter than the length of the longest fibre, but with the total, overall ratch considerably greater than that length. One or more of the intermediate sets of rolls is so constructed, preferably by spiral flutings, that a limited transverse portion of the fibres of the sliver (which at the start is about 2½ inches wide), is nipped more strongly at any one time and the point or points of stronger nip advance transversely of the fibres as the rolls rotate. I have found that that method of progressively varying the portion of stronger nip across the sliver contributes to the desired control and uniform distribution of the shorter fibres.

The last set of rolls rotates at a peripheral speed considerably greater than that of the first set for the desired high total draft and the intermediate set or sets of rolls rotate at such intermediate speeds as is conducive to a uniform advance and draft of the short, as well as the long, fibres.

These and further objects and advantages of my invention will appear from a more detailed description thereof in connection with the accompanying drawings, in which:

Fig. 1 is a perspective view of one end of a drawing frame embodying my invention;

Fig. 2 is a vertical sectional view taken through any one of the units of the drawing frame;

Fig. 3 is a side elevation view showing in detail the driving gears;

Fig. 4 is an elevation view of a set of spiral rolls as viewed from the line 4—4, Fig. 2, and

Fig. 5 is a perspective view of one of the mountings for either of the upper spiral rolls.

In Fig. 1 I have illustrated my novel drafting frame as embodying, in the usual way, a number of separate drafting units designated A, B, C, D, etc. These units are in all respects identical and, as indicated in Fig. 2, each may consist of a set of back rolls 1, two sets of intermediate rolls 3 and 5 and a set of front rolls 7. Disposed between the sets of rolls 1 and 3 I have indicated at 9 a set of so-called carrier and tumbler rolls and between the sets of rolls 3 and 5 I have shown another similar set of carrier rolls 11. The sliver, rove, slubbing, or the like, to be drafted, enters the frame from the back, as indicated at 13, and may pass through an eye 15 of a traversing member which causes the sliver to traverse back and forth across the upper rolls 17 and 19 of the set 1. The sliver passes thence around roll 19, between it and roll 21, around roll 21 and between it and roll 23. From the set 1 the sliver passes successively through the sets of rolls 9, 3, 11, 5 and 7 to a spindle 25 where it is wound up in the usual way.

The successive sets of rolls 1, 3, 5 and 7 are each positively driven and spaced from each other by ratches to be described. The back set of rolls 1 positively grips the sliver and rotates at a comparatively slow rate of speed. The first draft usually occurs between the sets of rolls 1 and 3 and the amount of draft and the ratch is predetermined and adjustable as hereinafter described.

The sets of rolls 3, consisting of an upper roll 2 and a lower roll 4, is preferably so constructed that a limited transverse portion of the sliver is nipped more strongly by the rolls at one time. This more strongly nipped portion moves progressively across the sliver as the rolls rotate. For that purpose, both rolls are preferably spirally fluted, with the same pitch, as indicated in

Fig. 4. To afford a yielding grip to obviate cutting of the fibres by the flutings and to cooperate with the spiral flutings, an apron 29, of leather or the like, passes between the nip of the rolls and around a tension roll 14 carried by a bracket 16 adjustable by thumb screw 18 for varying the tension in the apron. A second drafting is provided for, if desired, between the sets of rolls 3 and 5, spaced by a predetermined ratch. The set of rolls 5 consists of upper roll 31 and lower roll 33, each of which is preferably spirally fluted and has an interposed leather apron 29' just as described for the rolls 3.

The final draft, in the embodiment illustrated, is effected between the sets of rolls 5 and 7 and the set 7 consists of an upper roll 35 and a lower roll 37 between which the fibres are gripped more or less positively. The lower roll 37 may be scratch fluted and the upper roll 35 leather covered in the usual way.

To describe now the mountings for the several sets of rolls and the manner in which those mountings may be adjusted to regulate the various ratches—the front set of rolls 7 is preferably mounted in fixed position on the frame of the machine. The lower roll 37 of the set is secured to a shaft 41 carried in a bracket 43 secured, as by one or more bolts 45, to the bottom of an inclined runway 47 extending the full depth of the frame, as illustrated in Fig. 1. At its opposite end the shaft 41 is similarly mounted in a bracket secured to a runway, and where a number of units are employed, as illustrated in Fig. 1, the shaft 41 may extend entirely across the machine and carry, fixed to it, lower rolls 37 for the sets of rolls 7 of each unit A, B, C, D, etc. However, for the purpose of explaining the principle of my invention, I shall confine my description not only to one of the units, but to the bearings at one end only of the roll shafts, it being understood that similar bearings are provided at the other ends of the rolls and that where several units are carried on a single frame, suitable intermediate bearings and runways will be provided if desirable.

The upper roll 35 of the set 7 is mounted on a shaft 49 carried in a sliding bearing 51 received in a slotted upper extension of the bracket 43. Yielding pressure of the upper roll 35 against lower roll 37 is effected by a suitable spring 53 encircling rod 55 which passes through an aperture in an extension 51*a* of the bearing 51 and is suitably secured, as at 55*a*, to the bracket 43. Rotation of the thumb nut 57, threaded onto rod 55, effects the desired pressure between the two rolls.

The intermediate rolls 5 are slidably mounted for adjustment toward and away from the set of rolls 7 to vary the ratch or spacing therebetween. To that end the lower roll 33 of the set 5 is mounted on shaft 61 having a bearing in bracket 62 which is tongued at 63 for a sliding fit in groove 65 extending along the inclined plate 47. Bracket 62 may be secured in adjusted position, as indicated by nut and bolt 60 (Fig. 2). The upper roll 31 is mounted on shaft 67 journaled in a bearing block 69 (Fig. 5) slidably received in the groove 62*a* in bracket 62. To effect yielding pressure between the rolls 31 and 33, a rod 73, carrying spring 71, passes through an aperture 70*a* in a plate 70 connecting the opposite bearing blocks 69, the rod 73 being secured to a plate 72 connecting the opposite brackets 62. The spring pressure may be adjusted by the thumb nut 75 screw threaded onto the rod 73.

The set of rolls 3, consisting of upper roll 2 and lower roll 4 mounted on shafts 79 and 81 respectively, is similarly mounted on a bracket 83 sliding in runway 47 and secured in adjusted position by nut and bolt 50 to vary the ratch between the set 3 and the set 5. The upper roll 2 is yieldingly pressed aaginst the bottom roll 4 by spring pressure means 85 constructed as above described in connection with the set 5.

The back set of rolls 1 is carried on a standard 91 tongued for a sliding fit in groove 65 and secured in adjusted position by one or more bolts 95.

It will be apparent from this construction that the several sets of rolls are adjustable toward and away from each other to obtain desired spacings or ratches as hereinafter described.

In the preferred embodiment of my invention I also provide, as stated, sets of carrier rolls 9 and 11 intermediate the first and second ratches. These carriers may be of usual construction and in the set of carriers 9, for example, the lower roll 101 is mounted on a shaft 103, positively driven if desired, and the upper roll 105, constructed of wood or steel depending upon the amount of drag desired, merely rests upon the sliver passing over the bottom roll. The shaft 103 of the lower roll is mounted on a bracket 107 slidably secured in the grooved inclined track 47 as by the bolt and nut 109. The shaft 111 of the upper roll is carried in the slot 113 formed in the upper end of bracket 107.

The set of carriers 11 may be similarly constructed and mounted although, in the embodiment illustrated, the lower roll of the set 11 is not power-driven but merely idles as does the top roll.

Referring now to Figs. 1 and 3, I will describe the gearing by which the several rolls are driven, the manner in which the gears are kept in mesh when the ratches are varied and the way in which adjustable gears may be substituted for the purpose of changing the relative speeds of the rolls and thereby the amounts of the successive drafts.

The shaft 41 of the lower front roll is driven from a source of power, not shown, to rotate in the direction indicated. A gear 150 secured to shaft 41 meshes with idler 152 secured to stud shaft 154 which also carries fixed to it the pinion 156 meshing with pinion 158 secured to the aforesaid shaft 61 of the lower, spirally fluted, roll in the set 5. The upper, spirally fluted roll 31 may be driven from the lower roll 33 by the intermeshing of their spiral flutings.

Idler gear 152 also meshes with a second idler 160 fixed to stud shaft 162 to which idler 164 is also secured. Gear 164 meshes with idler 166 carried on stud shaft 168 and the gear 166 also meshes with gear 170 fixed to the aforesaid shaft 81 of the lower spirally fluted roll in the set 3, from which roll the upper spirally fluted roll 2 may be driven by peripheral engagement.

To drive positively the back set of rolls 1 the idler gear 160 meshes with a gear 171 mounted on shaft 172 to which shaft, gear 174 is also secured. Gear 174 meshes with gear 176 carried by a shaft 178 to which the bottom roll 23 (Fig. 2) of the set 1 is secured. As indicated in Fig. 2, the rolls 17, 19, 21 and 23 are geared together by the gear train 180, 182, 184 and 186 secured to their respective shafts.

To drive the lower roll 101 of the set of carriers 9, its shaft 103 carries pinion 188 meshing with idler gear 190 carried by stud shaft 192 and meshing with a gear 194 secured to the aforesaid shaft 178.

It is thus apparent that as shaft 41 is power-driven in a counterclockwise direction, the other shafts, gears and rolls will rotate in the directions indicated by arrows in Fig. 3.

As stated above, the set of rolls 7 only is immovably secured to the inclined runway 47 and the other sets, by their sliding brackets above described, are adjustable toward and away from each other and the set 7 to vary the several ratches.

To maintain the gears in mesh with each other during such ratch adjustment the following construction is employed. Stud shaft 154, on which gears 152 and 156 are mounted, is carried in a bracket 200 rotatably carried by the shaft 61 and adapted to be swung around the axis of that shaft and secured in adjusted position by lock nuts and bolt 202 passing through an arcuate slot 204 in a fixed frame member. By this construction, when the ratch between the set of rolls 7 and 5 is adjusted, the gear 152 may be made to mesh with gear 150 for any ratch and as the bracket 200 swings around shaft 61 as a center the gears 156 and 158 will always remain in mesh. Similarly, when the desired ratch between the sets 3 and 5 has been obtained, intermeshing of idler 160 with gear 152 is effected by suitably positioning bracket 206 rotatably mounted on shaft 81 and carrying the shafts 162 and 168. Locking means 208 passing through arcuate slot 210 holds the gears 156 and 160 in mesh with each other.

When the desired ratch between the sets of rolls 1 and 3 has been obtained, two gear meshing adjustments are made. Stud shaft 172 carrying gear 171 which meshes with gear 160 and also carrying gear 174 meshing with gear 176, is carried by a bracket 212 having a slot 214 adapted to receive a tightening bolt 216 screw threaded into the frame. By loosening the bolt 216 a wide range of positions of gears 171 and 174 may be obtained and the proper position is chosen for mesh with the gears 160 and 176 respectively as illustrated. The second adjustment required is that of idler gear 190 which meshes with gear 194 and pinion 188. For this purpose shaft 192 of gear 190 is carried on a bracket 220 through whose arcuate slot 222 a bolt 224 passes for securing the gear in the meshed position described. As will be apparent, the carriers 9 may be driven in any position to which they are adjusted, by suitably positioning gear 190.

My machine not only has the capacity for such ratch adjustment but also is preferably provided with means for varying the amount of draft in each ratch, depending upon the type of staple being drafted. To obtain the proper draft for a given set of conditions, the proper gear ratios are chosen to give the necessary differences in the peripheral speeds of the successive sets of rolls 1, 3, 5, and 7, and to vary the several drafts suitable change gears must, of course, be provided. The manner of changing the gears is obvious and need not be described, but it is to be noted that the movable brackets above described for varying the positions of the various idler gears, also provides for intermeshing of the gears when one or more in the train is changed.

In operation, the rolls 1 positively grip the fibres without slippage and are rotated at a predetermined rate of speed. The first draft may occur between the rolls 1 and the rolls 3 and, for that purpose, the latter are rotated at a slightly greater peripheral speed than the set of rolls 1 to draft the fibres held by the latter. The rolls 2 and 4, as stated above, are so constructed that a portion of the fibres transversely of the sliver are nipped more firmly at one time and so that the portion of firmer nip will traverse the fibres as the rolls rotate. I have accomplished that result by forming the surfaces of both rolls with ribs that have a spiral curvature as illustrated in Fig. 4. I have employed ribs that are rather widely spaced in the proportion of a 3/8 inch space between ribs that are about 1/8 inch wide at their edges and 1/8 inch or more in height disposed at an inclination of about 16 degrees, and with the pitch illustrated the fibres are nipped more strongly at two limited points at any one time. The pitch of the ribs as well as their width, spacing, height and the number of simultaneous nip points may be varied and yet produce the desired result. The flutings of these rolls intermesh with each other in that the apron 29 running between them causes the upper roll to be driven by the lower roll and the apron affords a resilient or yielding nip so that no appreciable breakage or cutting of the fibres occurs. As a result of the limited stronger nip, whether in one or more places at a time, which gradually moves across the fibres as the rolls rotate, there will not be a bunching of the fibres as heretofore with rolls which nip all of the fibres transversely of the sliver with equal firmness at one time. Even with approximate axial flutings in combination with the apron and yielding tension, bunching is less than if smooth rolls are used.

The set of rolls 5 is preferably constructed precisely the same as the set 3, but will be rotated at a greater peripheral speed if further drafting is desired between the sets 3 and 5.

The final draft occurs between the sets of rolls 5 and 7 with the set 7 rotating at a peripheral speed somewhat greater than the rolls 5.

The ratch between the successive sets of rolls may vary considerably as may the relative peripheral speeds of the rolls, to provide the proper total amount of draft depending upon the type and lengths of fibres being drafted. I have found that best results are obtained for the most common grades of worsted by making the first ratch, between the sets of rolls 1 and 3, slightly longer than the longest length of fibre; the second ratch less than the length of the longest fibre and approximately 50% to 75% of that length and the ratch of the third draft still less and approximating 40% to 60% of the length of the longest fibre. Thus, for a worsted sliver having a 6 inch maximum fibre length I have successfully used a first ratch of 6¼ inches, a second ratch of 4 inches and a third of 3½ inches. For a 9¾ maximum staple length I have used a first ratch of 10 inches, a second of 5 inches and a third of 4½ inches. These ratches may, of course, be varied considerably.

It will be observed that some of the foregoing ratches are considerably shorter than the length of the longest fibre. I have found that little or no fibre breakage occurs which I attribute partly to the gradual nipping afforded by the rolls 3 and 5, partly to the resiliency of their bites resulting from the leather aprons and partly to a certain amount of slippage effected by a moderate compression of the rolls by properly adjusting the screws 75 and/or 85.

To restrain, further, the tendency of the short fibres to bunch, I may, and preferably do, provide the carrier rolls illustrated. The positively driven lower roll of the set 9 is rotated at a peripheral speed approximating the average

peripheral speeds of rotation of the rolls 1 and 3.

The amount of total overall draft as well as the individual drafts may be varied considerably, depending upon the grade and lengths of staple, atmospheric conditions, and the like, and change gears are employed, as above noted, to meet these conditions. Generally speaking, I have obtained best results by effecting the greatest draft in the first ratch between the sets of rolls 1 and 3, the least draft in the middle ratch and an intermediate amount of draft in the front ratch. As a specific example of typical drafts for different grades of worsted top sliver I have, in practice, obtained a total draft of 6.6 by employing successive drafts of 3.04, 0, and 2.19. For a 16.4 total draft I have used successive drafts of 5.62, 1.11 and 2.63. It will, of course, be appreciated that the foregoing values are given only by way of illustration and that my invention is not to be limited thereto except as indicated in the appended claim.

From the foregoing description of the construction and mode of operation of my novel drafting frame, it will be apparent that the objects of my invention herein set forth have been attained. It will be noted that at any one time only a portion of the fibres transversely of the sliver are nipped most firmly by the spiral rolls and that in any line lengthwise of the sliver the firmness of the nip is intermittent, which also acts to produce the desired fibre distribution conducive to evenness in thickness of the sliver and also minimum breakage of the fibres. By this mechanism I am able to draft repeatedly in the same direction substantially regardless of the lengths of fibre or of the variations in those lengths, and the evenness obtained by this method of drafting eliminates the necessity for doubling, for the number of drafts obtained in the frame described.

By my invention therefore I have been able to draw a number of times in the same direction in the same drafting frame and to produce a much higher draft than usual. By this means I have been able to eliminate a number of the separate drafting operations customarily employed while producing a sliver of good even quality.

In the following claim when I speak of intermeshing flutings or ridges, I mean to include such intermeshing as may result from the presence of an interposed apron 29 or similar roll cover when one is employed.

I claim:

A drafting frame for drafting worsted having, in combination, four sets of drafting rolls successively spaced apart by predetermined ratches, the first of which ratches is greater than the length of the longest fibre, the second of which ratches is less than the length of the longest fibre and the last of which ratches is shorter than said second ratch, all of said rolls rotating at predetermined peripheral speeds to effect a plurality of drafts in the same direction, at least one of which sets of rolls is formed with surface flutings that effect varying strengths of nip as the rolls rotate and having a resilient apron interposed between them at their bite to minimize cutting and rupture of the fibres during drafting.

HARRY LAMBERT.