Nov. 29, 1966 A. RAKHORST 3,287,768

HIGH SPEED COTTON DRAW FRAME

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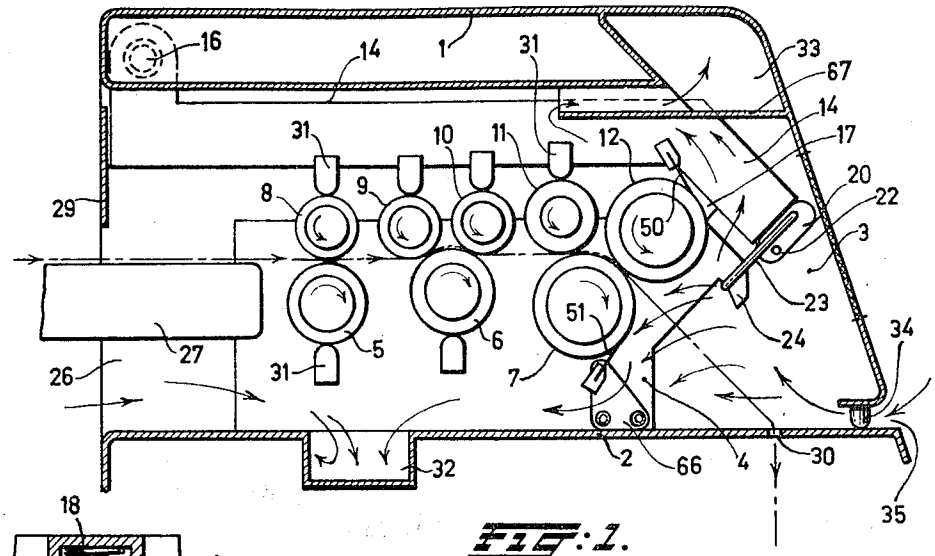

Fig. 1.

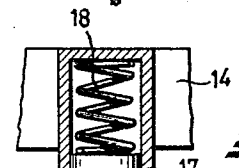

Fig. 4.

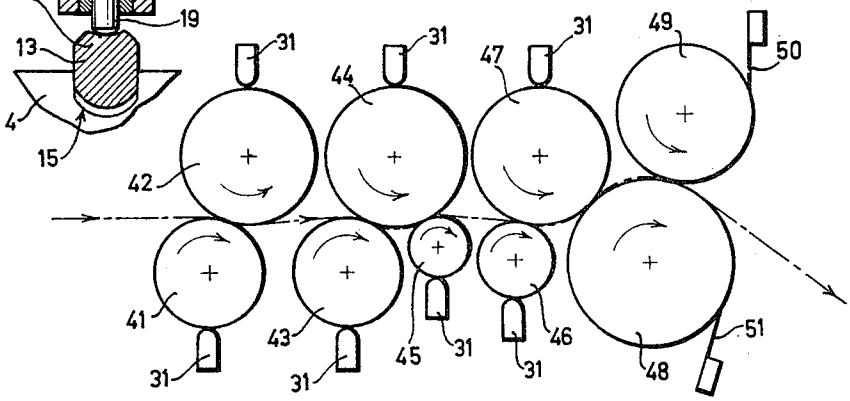

Fig. 2.

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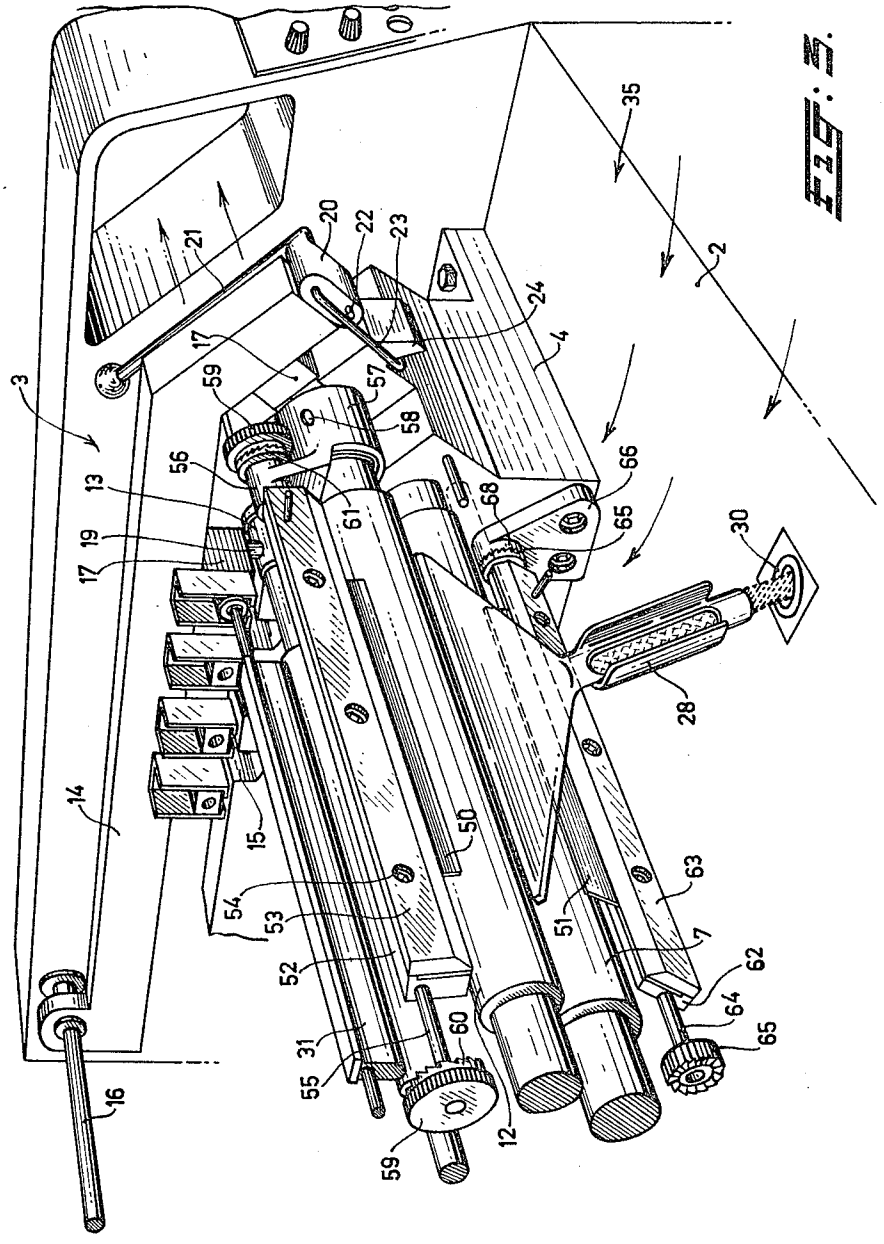
FIG. 5.



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HIGH SPEED COTTON DRAW FRAME

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Filed Dec. 17, 1965, Ser. No. 514,494
Claims priority, application Netherlands, Jan. 4, 1961, 259,697
10 Claims. (Cl. 19—200)

This application is a continuation-in-part of application Ser. No. 150,393, filed November 6, 1961, now abandoned.

This invention relates to cotton spinning and especially to the removal of seeds, leaves and other vegetable impurities from cotton fibrous webs.

Certain types of raw cotton contain so many seeds, leaves and other impurities, that these impurities cannot completely be removed in the initial spinning stages such as opening and carding. Thus, it is highly desirable to take special measures for removing these impurities in later stages of the spinning process, as otherwise the cloth woven from the resultant yarn has an unacceptable speckled appearance from the presence of such impurities.

In wool spinning systems, it has been proposed to mount pairs of fluted rolls at the delivery end of sets of drawing rolls, for dividing foreign bodies within the wool into smaller particles by coaction of the teeth and grooves of the pairs of fluted rolls. This system is illustrated in Patent No. 2,509,148. This expedient cannot be used for cotton, however, since it is not technically feasible to make the teeth and grooves of the rolls sufficiently fine that they can efficiently act upon the relatively small impurities in a cotton web so as to cut such impurities into smaller particles. Moreover, due to the differences in fibre character, there is a serious likelihood of damage to the cotton fibres themselves by such treatment.

One of the prior procedures for removing such impurities from cotton fibres has been to mount a pair of heavy, smooth steel rolls at the delivery end of the carding engine employed in the spinning process and to press these rolls together with such force that the seeds and other impurities are crushed and pulverized to dust particles which drop out of the cotton web during further processing. However, this expedient is expensive, as well as unsatisfactory, because it requires the use of a pair of precision ground heavy rolls of high quality steel each having a diameter of about 3 inches and a length of about 40 inches and the production of a carding engine equipped with these rolls is, at most, about 40 pounds of cotton per hour.

Before this invention, to use a pair of smooth coacting pressure rolls at the delivery end of the sets of drafting rolls of a cotton draw frame, has not been considered practicable since the web leaving a draw frame is about 6 to 8 times thicker than the web leaving a carding engine and experience with the smooth crushing rolls on carding engines as described has taught that the web must be very thin, preferably in the order of 55 to 65 grains per square yard.

The present invention is based upon the discovery that very good results in the removal of foreign bodies can be obtained by smooth crush rolls on a cotton draw frame, even at high speed, if the conditions set forth hereinafter are observed.

It is an object of the invention to provide a high speed cotton draw frame comprising means for crushing and disintegrating seeds, leaves and other impurities in the processed cotton slivers.

A further object of the invention is to include in such a draw frame means for removing the crushed and disintegrated impurities from the crush rolls.

With these and other objects in view, as will hereinafter more fully appear and which will be more particularly pointed out in the appended claims, reference is now made to the following description taken in connection with the accompanying drawings, in which:

FIG. 1 is a cross section of the upper part of a high speed cotton draw frame equipped with the crush rolls according to the invention.

FIG. 2 is a schematic view of an alternative arrangement of the draft rolls and crush rolls in a draw frame according to FIGURE 1.

FIG. 3 is a perspective view of certain parts of the draw frame according to FIGURE 1.

FIG. 4 is a cross section of details of the roll loading device.

The drawings show only the upper part of a high speed cotton draw frame, namely the part comprising the drafting apparatus since the other parts of the draw frame may be of conventional construction, a description of which is not necessary for an understanding of the invention.

The drafting mechanism of the draw frame is mounted within an enclosure, usually of sheet steel, comprising an upper part or cap **1** which can be swung upwards so as to provide access to the drafting apparatus, a bottom **2** and a pair of side walls **3**, only the right side wall **3** being shown. Generally in a draw frame there are at least two such drafting mechanisms side by side and preferably each drafting unit has a separate enclosure so that for servicing one need only lift the cap **1** of a single unit. Thus, there would also be a second lateral wall not shown at the left of FIG. 3, and the cap **1** would only extend between the wall **3** shown and the corresponding wall at the left of FIGURE 3.

Within the space enclosed by the cap **1**, the bottom **2** and the lateral walls **3**, there are frame members, such as **4**, for carrying the ends of a plurality of rolls which constitute the drafting mechanism. In FIGURE 3, a frame member **4** is shown at the right end of the drafting apparatus, but it will be understood that there will also be a corresponding frame member at the left end of said apparatus.

In the embodiment of FIGURES 1 and 3, there are three lower rolls **5**, **6** and **7**, each journalled in bearings not shown in the frame members **4** at both ends of each roll. The rolls **5**, **6** and **7** have a central or operating portion of increased diameter, the operating portion of the rolls **5** and **6** being provided with longitudinal or helical grooves while the operating portion of the roll **7** has a smooth metallic surface, preferably of polished steel. Cooperating with the lower rolls **5**, **6** and **7** are five upper rolls **8**, **9**, **10**, **11** and **12**, each of said upper rolls being journalled on the frame member **4** by bearings at their ends of reduced diameter. In FIGURE 3, such a bearing **13** on the right end of roll **11** is shown, it being understood that the other bearings are of similar construction. The bearings **13** of the five upper rolls **8**, **9**, **10**, **11** and **12** rest in recesses **15** in the upper face of the frame members **4** and are held therein by the action of a pivoted pressure arm **14** which will be described later. Upon moving upwardly the pivoted pressure arm **14**, the upper rolls **8**, **9**, **10**, **11** and **12** with their bearings **13** can be lifted from the recesses **15** of the frame member **4**, as for servicing or replacement. The upper rolls **8**, **9**, **10** and **11** have a central or operating portion of increased diameter which is preferably covered with rubber or like tough, resilient polymeric material. The central or operating portion of increased diameter of the upper roll **12** has a smooth metallic surface, preferably of polished steel.

The pressure arm **14** is pivoted on a shaft **16** which extends parallel to the rolls **5–12** and which is fixed at its ends in the side walls **3** of the draw frame. There is,

of course, another pressure arm, not shown, for the other ends of the rods. Each arm **14** extends forward from the shaft **16**, at a certain distance over the upper end of the frame member **4**, and the foremost portion of each arm **14** is downwardly inclined in conformity with the downwardly inclined foremost portion of the upper part of the frame member **4**. Referring more particularly to FIGURE 4, this shows one of the recesses **15** of the frame member **4**, and the associated lower face of pressure arm **14** which latter is provided with a box-like extension **17**, containing a heavy spring **18** and a sliding pressure pin **19** loaded by the spring **18**. Similar means are provided at each end of each of the several rolls.

The forward end of each pressure arm **14** carries a pivotally mounted L-shaped lever **20, 21**, the part **20** of the lever extending in front of the front face of the arm **14** and the handle **21** extending laterally of and parallel to the foremost part of the arm **14**. The lever **20, 21** pivots about pin **22** which is fixed to the front face of the arm **14**. The part **20** of the lever carries a pivoting brace **23**, which may be engaged behind a nose portion **24** of the front face of the frame member. The lever **20, 21** and the brace **23** form a toggle linkage so that by engaging the brace **23** under the nose **24** and moving the lever arm **21** rearward, toward the pressure arm **14**, the latter is drawn toward the frame member **4**, and the pressure pins **19** of the extensions **17** of the pressure arm **14** thereby exert pressure on the bearings **13** of the upper rolls **8–12**. The pivot pin **22** is so located with respect to the lever part **20** and the brace **23**, that the brace **23** may be moved somewhat past the pin **22** for obtaining a self-locking position of the toggle linkage. Referring again to FIGURE 4, the bearings **13** are provided with a recess **25** in the area which engages with the pressure pins **19** so that when applying the presure arm **14**, the pins **19** not only apply a downward pressure to the upper rolls **8–12** but also prevent rotation of the shaft portions of those rolls by engagement in the recesses **25**.

The lower rolls **5, 6, 7** extend past the frame member **4**, and through the lateral wall **3** into the casing at the far side of said wall, the lateral wall **3** forming part of said casing. Said casing contains gears and further drive mechanism, not shown, for driving the rolls **5, 6, 7** clockwise as indicated in FIG. 1, at relatively increasing circumferential speed, that is so that the roll **5** (retaining roll) has the lower speed, the roll **6** (intermediate roll) has an increased speed, and the roll **7** (delivery roll) has a higher speed than the roll **6**. The rolls **8, 9, 10, 11** and **12** are driven by surface contact with the rolls **5, 6, 7** so that they rotate counter-clockwise as indicated in FIG. 1.

The rear wall **29** of the enclosure of the drafting mechanism is provided with an aperture **26** through which extends a guide bar **27** over which a plurality of cotton slivers can be fed in known manner from a plurality of cans into the nip of the paired retaining rolls **5, 8** of the mechanism. After passing the several rolls of the drafting apparatus, the slivers leave the front rolls **7, 12** as a unitary web, which is condensed by the trumpet **28** into a sliver, which passes through a hole **30** in the bottom **2** of the enclosure of the drafting apparatus to the coiler device, not shown, which is arranged in known manner below the bottom **2**.

The rolls **5, 6, 8, 9, 10** and **11** are provided with clearer bars or rubbers **31** which serve to clear the rolls from accumulated lint. The rubbers engaging the upper rolls **8, 9, 10, 11** are mounted between the pressure arms **14** so that they are lifted together with the pressure arms **14**.

In the bottom **2** of the enclosure of the drafting apapparatus, there is an air exhaust conduit **32** and in the lateral wall **3** there is an air exhaust conduit **33**, both conduits being connected to a source of suction, whereas the lower edge of the front portion of the cap **1** is provided with spaced protrusions **34** so as to leave an air

inlet slot of about ½" wide between the cap **1** and the body **2**. When operating, the suction in **32** causes an air flow from the slot **35** past the several rolls to the exhaust conduits **32** and **33**, said air flow serving to pick up and carry away the accumulated lint.

With the exception of the front rolls **7** and **12**, the apparatus so far described is of known construction. The known apparatus, however, in place of the rolls **7** and **12**, is provided with a grooved lower roll cooperating with the rubber covered upper roll **11** which constitute the set of delivery rolls of the drafting mechanism. When operating the known machine, the slivers (usually 6 or 8 in number) entering via the aperture **26**, are forwarded by the pair of retaining rolls **5, 8** to the intermediate rolls **9, 6**, which, rotating at higher speed, attenuate the set of slivers and forward them again in cooperation with the upper roll **10**, and the pair of delivery rolls **11** with the aforesaid grooved roll replacing the roll **7** further attenuate the slivers once more, the slivers being also spread out laterally, so that at the nip of the pair of delivery rolls, there is a unitary web of cotton fibres, formed by the combination of the original set of slivers. After condensing of this web by the trumpet **28**, the resultant sliver will have about the same count as one of the original slivers, taking account of the attenuation which has taken place in the drafting apparatus. The small fibres liberated from the web during the process are cleared from the rolls by the rubbers **31** and are carried away by the air flow toward the exhaust tunnels **32** and **33**.

According to the invention, the drafting apparatus contains means for crushing and disintegrating seeds, leaves and other vegetable small impurities which are present in the processed cotton slivers. This is done by the pair of smooth rolls **7, 12**. The lower roll **7** of this pair replaces the conventional grooved lower roll of the set of delivery rolls of the conventional drafting apparatus and, as stated above, it has a smooth metallic surface, preferably of polished high grade steel. Although the roll **7** lacks the usual longitudinal grooves of lower rolls of drafting apparatus, it has been found that it can adequately perform the second attenuating step of the drafting process together with the upper roll **11**. The roll **7** further cooperates with the upper roll **12** of similar construction for exerting a high pressure on the web, which, upon leaving the pair of delivery rolls **7, 11** enters the nip between the crush rolls **7** and **12**. It should be noted that the roll **7** has both the function of delivery roll in combination with the roll **11** and the function of crush roll in combination with the roll **12**. The high pressure between the rolls **7** and **12** (caused by the spring **18** and the pin **19** acting on both ends of the roll **12**) acts to crush the seeds, leaves and other small vegetable impurities in the cotton web and to pulverize them so that they become dust particles.

For efficient operation, the diameter of the operating part of the rolls **7, 12** is preferably greater than the diameter of the draft rolls, namely in the order of 2". Further, the force with which the roll **12** is pressed on the roll **7**, should be in the order of 100 to 140 pounds at each end. It will be appreciated that the rolls **7, 12** in view of their relatively small diameter and limited length (less than 8") are much cheaper than similar but bigger rolls at the delivery end of a carding engine, and moreover, the initial cost of these rolls only slightly increases the cost of spinning per pound of cotton in view of the fact that a draw frame of the type described can operate at a delivery speed of 800 feet per minute which means an output of about 240 pounds of cotton per hour. Even when using such crush rolls in both draw frames of two consecutive drafting operations in the spinning process the initial cost of this seed removing equipment adds very little to the spinning cost per pound of cotton treated.

FIG. 2 shows more-or-less diagrammatically an alternative arrangement of the several rolls, in which there is

a pair of retaining rolls **41**, **42**, a pair of intermediate rolls **43**, **44** an additional lower roll **45** in surface contact with the roll **44** for enhancing the grip of the rolls on the passing slivers, a set of delivery rolls **46**, **47** and a set of crush rolls **48**, **49**. In this alternative arrangement, the lower crush roll **48** is also in surface contact with the upper delivery roll **47**, but only for enhancing the grip of the rolls on the sliver or web, the roll **46** exerting the attenuating force upon the sliver or web.

Both in the embodiment of FIG. 1 and in the embodiment of FIG. 2 it has been found necessary for good results that the lower crush roll **7** respectively **48** has surface contact with the upper delivery roll **11** resp. **47** and thus forms part of the drafting apparatus itself. In the embodiment of FIG. 1, the lower crush roll **7** takes an active part in the attenuation of the slivers or web, whereas in the embodiment of FIGURE 2, the lower crush roll **48** enhances the grip of the upper delivery roll **47** upon the web.

Although the seed removing device as described above operates quite well at moderate speeds of the draw frame, the dust particles resulting from the pulverizing of the seeds, leaves and other impurities cause difficulties at the extremely high speeds of about 800 feet per minute of which modern draw frames are capable, since not all of the dust particles drop out of the web, but much of them accumulate on the crush rolls because of the oil and wax contained in the very small seeds which form part of the impurities. Upon crushing those seeds, the oil and wax form a thin sticky layer on the crush rolls which not only holds the seed particles, but also dry leaf particles and small fibres. This causes roll lapping in that the web leaving the drafting apparatus winds about the crush rolls.

Thus, a draw frame operating at high speed is according to a further feature of the invention, provided with scraper blades or doctor blades **50** on the upper crush roll and **51** on the lower crush roll. But in itself, the scraper blades **50**, **51** do not present a solution of the problem, since the dirt scraped away by the doctor blades accumulates in front of the blades in a very short time and ultimately drops back upon the delivered web, so that the impurities mix with the cotton fibres again. Accordingly, the draw frame is provided further with means for removing and discharging the dust particles obtained by the crushing action of the crush rolls upon the seed, leaves and other impurities in the cotton.

The upper doctor blade **50** is held against a mounting block **52** by means of a bar **53**, a plurality of screws **54** holding the bar **53**, the blade **50** and the block **52** together. The blade **50** is narrower than the operating portion of increased diameter of the crush roll **12** and preferably its width corresponds as accurately as possible to the width of the web leaving the rolls **7** and **12**. As stated above, the portion of the crush rolls **7** and **12** which is in contact with the cotton web, is covered with a thin layer of oil and wax which causes a lubricating action between the blade **50** and the roll **12**, so that wear of the blade **50** is prevented. But since the operating portion of the rolls **12** and **7** is wider than the web width, the outer portions of the rolls are not covered by wax and if the blade **50** is wider than the web, the outer portions of the blade will wear away at a fast rate because of their contact with a dry roll part. Protruding from either end of the block **52** is a shaft **55** which is fixed against rotation in the center of the block **52** but further extends freely to both ends of the block **52** through a suitable bore of the block. The protruding ends of the shaft **55** are journalled in a lug **56** protruding from the upper end of a bush **57** which is fixed against rotation on the bearing **13** on the end of the roll **12**. As described above, the bearing **13** is held against rotation in a recess **15** of the inclined front part of the frame member **4**, by a pin **19** of the loading arm **14**, which pin is itself loaded by a pressure spring **18** contained in an extension **17** of the arm **14**, so that the pin **19** also provides the pressure which presses the roll **12** onto the roll **7**. Although FIG. 3 only shows the bushing **57** at the right end of the roll **12**, it will be apparent that a similar bushing **57** is also provided at the left end of the roll **12**. The bushing **57** may be held rigidly on the bearing **13** by a set screw **58**. Each end of the shaft **55** carries an adjusting knob **59** which has a knurled circumference and which has a lateral set of lock teeth **60** which engage with similar lock teeth **61** on the outer end of the lug **56**. The knob **59** is movable to a limited extent against spring pressure in axial direction, but it is not rotatable with respect to the shaft **55**. Thus, by rotating the knob **59** so far that the lock teeth **60**, **61** disengage and reengage one tooth further, the shaft **55** is torsioned with respect to its central mounting and this torsion causes a pressure of the blade **50** on the roll **12**. In actual operations, it has been found that the pressure of the blade **50** on the roll **12** should be adjusted within the range of 2 to 4.5 pounds, such that the pressure of the blade **50** on the roll **12** is just sufficient to prevent lifting of the blade by the accumulating dust. By rotating the knob **59** in either direction, one should adjust the pressure of the blade **50** (within the range of 2 to 4.5 pounds) until the most satisfactory operation of the blade is obtained.

The mounting of the lower blade **51** for scraping the roll **7** is similar to the mounting of the blade **50** as to the mounting block **62** and bar **63** which hold the blade **51** and as to the shaft **64**. But the teeth of the adjusting knob **65** on the shaft **64** face outwards and the shaft **64** is journalled in a bracket **66** which is fixed against the frame member **4** and which carries teeth **68** facing inwards to engage the teeth of the knob **65**.

The position of the brackets **66** with respect to the frame members **4** and also the position of the bushing **57** with respect to the bearings **13** of the roll **12** are so selected that the lines of contact of the doctor blades **50** and **51** with their respective rolls **12** and **7** are spaced from the nip of the rolls **12** and **7** in the direction of rotation of said rolls at an angle of about 90° for the blade **51** and about 180° for the blade **50** with respect to the center of the associated roll. Further, the blades **50** and **51** are positioned at a small angle of divergence with respect to the tangent to the roll **12** resp. **7** at the line of contact with the blade, said angle being preferably about 20°. The position of the blades **50** and **51** is critical for obtaining a good operation, it being of course understood that a certain latitude of the adjustment is permitted so as to take account of the prevailing conditions of operation.

As stated above, an air flow is caused from the slot **35** at the front of the enclosure of the drafting apparatus toward the exhaust passages **32** at the bottom and **33** at the top of the drafting apparatus. The air flow from the slot **35** toward the conduit **33** passes the blade **50** while the air flow from the slot **35** towards the tunnel **32** passes the blade **51**. The air flows should be very accurately guided by selection of the location and direction of the entrance and exhaust apertures and provision of further guide plates, if needed, since in the high speed draw frames in question, it is essential for the removal of the dust particles from the blades **50** and **51** that air currents are generated which pass close to and transverse to the line of contact between each blade and its associated crush roll and substantially parallel to the plane of the blade. In FIG. 1, the cover **1** of the enclosure contains a guide plate **67** which extends horizontally over the upper crush roll **12** and its associated doctor blade **50** so that the airflow from the slot **35** towards the exhaust tunnel **33** is forced over the blade **50** towards the exhaust entrance provided between the rear end of the plate **67** and the lower face of the cover **1** and connected with the exhaust tunnel **33**. As to the lower blade **51**, the spacing between its mounting block **62** and the bottom **2** of the enclosure of the drafting apparatus should be

selected so as to guide the air flow such that only a small portion of the total volume of air will pass directly from the slot **35** to the exhaust tunnel **32** and a larger amount of the air will follow a curved path upward, at both sides past the trumpet **28** and downward again, part of it passing close to the blade **51** for removing the dust.

It will be apparent that the position of the blades **50** and **51** and the lay-out of the guide means for the air flow in the enclosure have a direct interrelation and should be so selected that the desired air streams across the line of contact of the blade **50** with their respective rolls are obtained. The front side of the blades with their mountings, that is the side towards the air streams, should be kept as smooth as possible. By the cooperation of the features set forth, the air flow in the enclosure will carry along any dust which accumulates on the scraper blades **50**, **51** and discharge it via the exhaust tunnels before the dust can build up to a substantial extent upon the blades **50** and **51**. Since the air currents should be capable of carrying away the dust from the scraper blades, the air speed should be relatively high so that a relatively high suction should be used.

It will be noted that the embodiments described are only examples and that modifications are possible within the scope of the invention.

The means for mounting the scraper blades may differ from the embodiment shown, e.g. there may be provided a spiral spring or a helical spring for loading the shafts **55** or **64** instead of using those shafts themselves as torsion bar springs. Also, magnetic attraction may be used to hold the rolls **7** and **12** together or to hold the blades **50** and **51** on the rolls **7** and **12**.

The seed and crush removing device may be used in a single draw frame in the sequence of operation by which the raw cotton is spun into a yarn, but since it is customary to use at least two successive draw frames in the sequence of the spinning process, it is preferred to install the seed removing device on both draw frames of the sequence of operations, so that any impurities which have not been removed in the first draw frame, will be removed in the second draw frame. Even in mills which have already crush rolls on their carding engines, it will be advantageous to mount the present device on at least one draw frame subsequent to the carding engine so as to remove any impurities remaining in the cotton. It should be noted, however, that the pair of crush rolls should not merely be installed as a separate unit behind the drafting apparatus of a high speed cotton draw frame, but it should be incorporated into the drafting apparatus so that one of the crush rolls has surface contact with one of the delivery rolls of the drafting apparatus.

The invention does not impose limitations on the general construction of the draw frame and all conventional parts thereof may be of usual construction, it being only necessary to observe the conditions set forth for the mounting of the crush roll pair and for the cleaning means therefore. For instance, the spring loading of the several upper draft rolls and also of the upper crush rolls may be replaced by a weight loading. Instead of journalling the rolls in bearings such as **13**, the central or operating portion of the draft rolls and of the crush rolls may be mounted via anti-friction bearings on a stationary shaft which extends through the hollow rolls and which is held in a fixed angular position. Thus, there is less danger of accidental small changes e.g. in the angular position of the doctor blade **50**. Instead of the rubbers **31**, other means for clearing the rolls may be used. The air flow around the crush roll system may be provided by blowing air into the enclosure instead of exhausting air from the enclosure as described.

These and other modifications will be apparent to those skilled in the art and it is intended to cover all changes and modifications of the preferred embodiments of the invention herein chosen for the purposes of the disclosure which do not constitute departures from the spirit and scope of the invention.

What I claim is:

1. High speed cotton draw frame comprising drafting means including a series of groups of interengaging upper and lower draft rolls and a pair of interengaging smooth metal surfaced crush rolls so as to constitute successive nips, means for rotating the rolls for forwarding a plurality of carded cotton slivers through said nips from the entrance end to the delivery end of the drafting apparatus, successive groups of upper and lower draft rolls running at increased circumferential speeds relative to the preceding group of rolls so as to attenuate the slivers and form them into a web, the pair of crush rolls being situated at the delivery end of the drafting means and receiving the web, pressure means for causing pressure between the rolls of each group of draft rolls and between the pair of crush rolls, the pressure between the pair of crush rolls being selected to crush and disintegrate seeds, leaves and other impurities entrained in the web passing through the nip of the crush rolls, the lower crush roll being in surface contact with the last draft roll in the sequence of groups of draft rolls and pressure means causing pressure between the lower crush roll and said last draft roll.

2. High speed cotton draw frame as claimed in claim **1**, comprising a first driven lower draft roll, a first upper draft roll in surface contact with said first lower draft roll so as to advance a plurality of slivers forwarded into the nip of said first lower and upper draft rolls, a second lower draft roll driven at a higher circumferential speed than said first lower draft roll, two upper draft rolls in surface contact with spaced areas of said second lower draft roll so as to grip and attenuate the slivers leaving said first lower and upper draft rolls and to further forward said slivers, a lower crush roll driven at a higher circumferential speed than said second lower draft roll, a last upper draft roll in surface contact with said lower crush roll, an upper crush roll in surface contact with a further area of said lower crush roll, the lower crush roll in combination with the last upper draft roll and the upper crush roll gripping and attenuating the spread out cotton slivers leaving the group of said second lower crush roll and the two intermediate upper draft rolls.

3. High speed cotton draw frame as claimed in claim **1**, comprising a first driven lower draft roll, a first upper draft roll in surface contact with said first lower draft roll for advancing a plurality of slivers forwarded into the nip of said first lower and upper draft rolls, a second lower draft roll driven at a higher circumferential speed than said first lower draft roll, a third lower draft roll driven at an identical speed as the second lower draft roll, a second upper draft roll in surface contact with both said second and said third lower draft rolls for gripping and attenuating the slivers leaving the nip of said first upper and lower draft rolls, a fourth lower draft roll driven at a higher circumferential speed than said second and third lower draft rolls, a lower crush roll driven at an identical circumferential speed as said fourth lower draft roll, a third upper draft roll in surface contact with both said fourth lower draft roll and said lower crush roll for gripping and attenuating the spread out slivers leaving the group of said second and third lower draft rolls and said second upper draft roll, and an upper crush roll in surface contact with said lower crush roll.

4. High speed cotton draw frame as claimed in claim **1**, in which the diameter of the portions of the crush rolls which engage the fibrous web is a larger diameter than the portions of the draft rolls operating on the processed slivers.

5. High speed cotton draw frame as claimed in claim **1**, in which the pressure between the upper and lower crush roll is 100 to 140 pounds at each end.

6. High speed cotton draw frame comprising drafting mechanism including a series of groups of interengaging upper and lower draft rolls and a pair of interengaging

smooth metal surfaced crush rolls so as to constitute successive nips, means for rotating the rolls for forwarding a plurality of carded cotton slivers through said nips from the entrance end to the delivery end of the drafting mechanism, successive groups of upper and lower draft rolls running at increased circumferential speeds relative to the preceding group of rolls so as to attenuate the slivers and form them into a web, the pair of crush rolls being situated at the delivery end of the drafting apparatus and receiving the web, pressure means for causing pressure between the rolls of each group of draft rolls and between the pair of crush rolls, the pressure between the pair of crush rolls being selected to crush and disintegrate seeds, leaves and other impurities entrained in the web passing through the nip of the crush rolls, trumpet means for condensing the web leaving the crush rolls into a sliver, a doctor blade on each of said crush rolls spaced from their nip in the direction of rotation of said rolls and positioned at a small divergence angle from the tangent to the associated crush roll away from the nip of the pair of crush rolls, means for supporting each doctor blade so that it may rock about an axis parallel to and spaced from the associated crush roll, means for resiliently urging the end of each doctor blade against its associated crush roll, means for adjusting the resilient pressure of each doctor blade on its associated crush roll, an enclosure for the drafting mechanism inclusive of the crush rolls with doctor blades and the trumpet means for receiving the sliver, an air inlet to and an air outlet from the enclosed space of the enclosure, means for generating air flow through the enclosed space and means for guiding said air flow so that air streams adjacent and transverse to the line of contact between each doctor blade and its associated crush roll and substantially parallel to the plane of the doctor blade are provided, whereby disintegrated impurities accumulated on the doctor blades are carried along by the air streams to the air outlet.

7. High speed cotton draw frame as claimed in claim **6**, having means for guiding the air flow so as to generate two separate air streams diverging from each other at the delivery end of the nip of the pair of crush rolls and further flowing each transverse to the line of contact between the upper and the lower doctor blade respectively and its associated crush roll.

8. High speed cotton draw frame as claimed in claim **6**, in which the angle of divergence of the doctor blades with respect to the tangent to the associated crush roll is about 20°.

9. High speed cotton draw frame as claimed in claim **6**, in which the line of contact of the upper doctor blade is spaced at an angle of about 180° from the nip between the upper and lower crush rolls and the line of contact of the lower doctor blade is spaced at an angle of about 90° from the nip of the upper and lower crush rolls.

10. Drafting mechanism for a high speed cotton draw frame, including a series of groups of interengaging upper and lower draft rolls and a pair of interengaging smooth metal surfaced crush rolls so as to constitute successive nips, means for rotating the rolls for forwarding a plurality of carded cotton slivers through said nips from the entrance end to the delivery end of the drafting apparatus, successive groups of upper and lower draft rolls running at increased circumferential speeds relative to the preceding group of rolls so as to attenuate the slivers and form them into a web, the pair of crush rolls being situated at the delivery end of the drafting mechanism and receiving the web, pressure means for causing pressure between the rolls of each group of draft rolls and between the pair of crush rolls, the pressure between the pair of crush rolls being selected to crush and disintegrate seeds, leaves and other impurities entrained in the web passing through the nip of the crush rolls, the lower crush roll being in surface contact with the last draft roll in the sequence of groups of draft rolls and pressure means causing pressure between the lower crush roll and said last draft roll.

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