Feb. 23, 1937. S. A. SHORTER ET AL 2,071,438

METHOD OF AND MEANS FOR PRODUCING SLIVERS OR ENDS OF FIBROUS MATERIALS

Filed Nov. 10, 1934 2 Sheets-Sheet 1

Fig. 1.

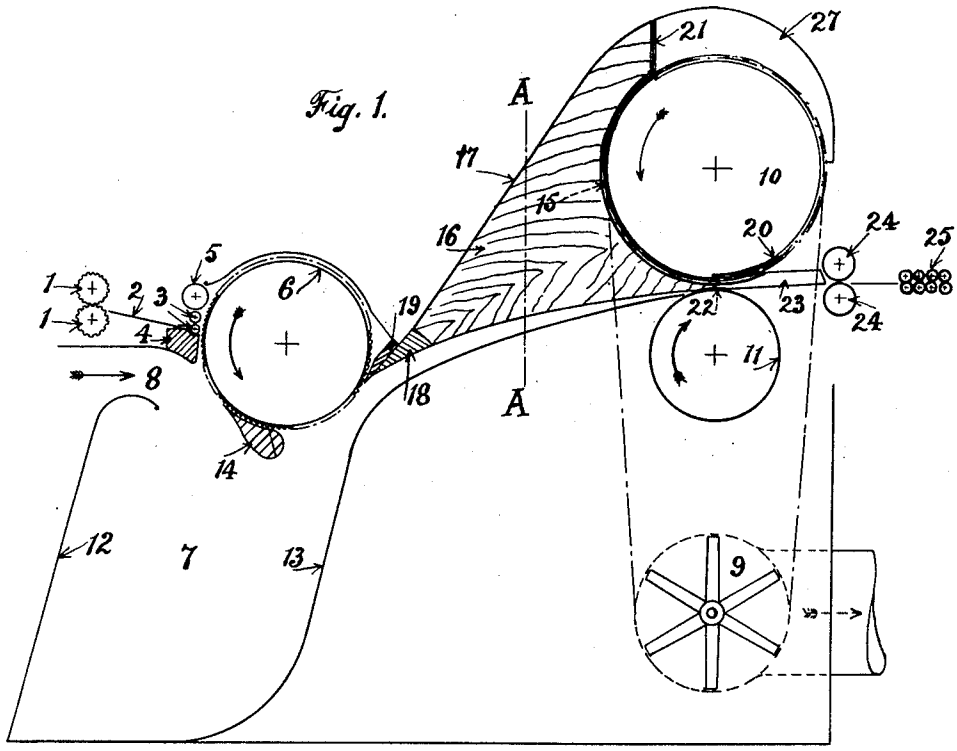
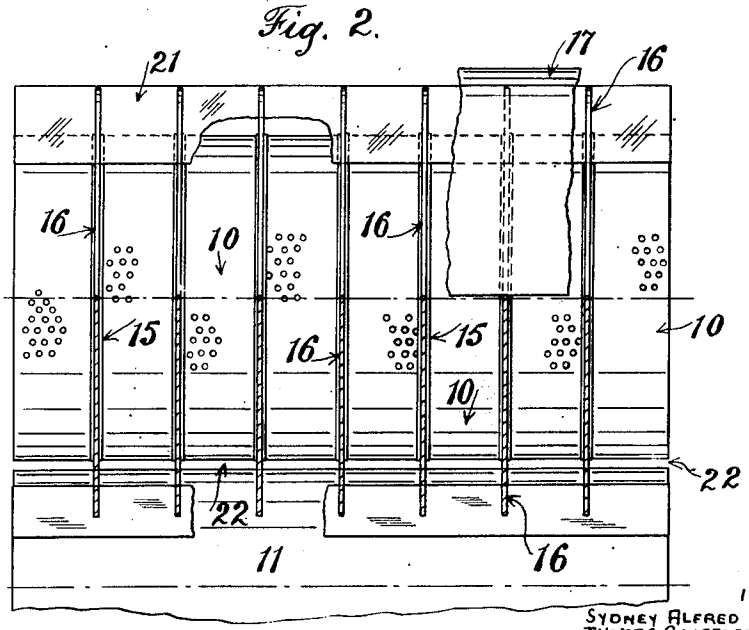



Fig. 2.



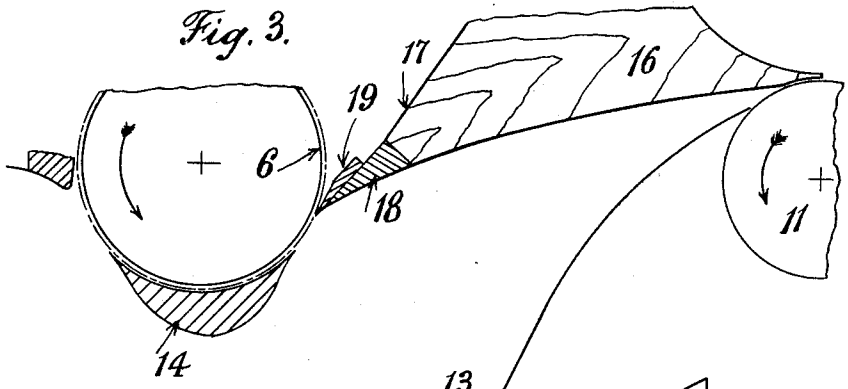

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Fig. 3.



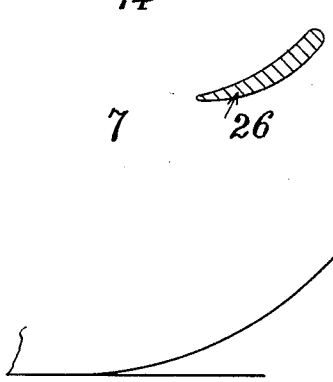




Fig. 5.

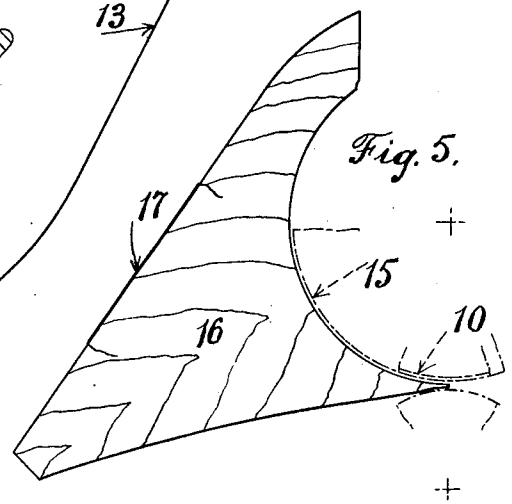



Fig. 4

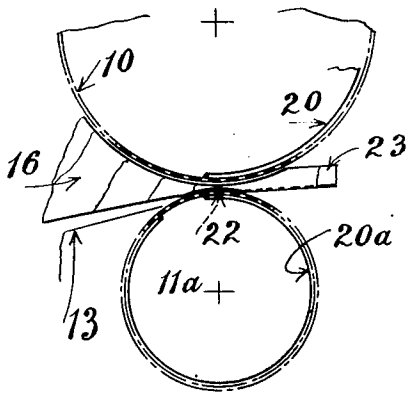
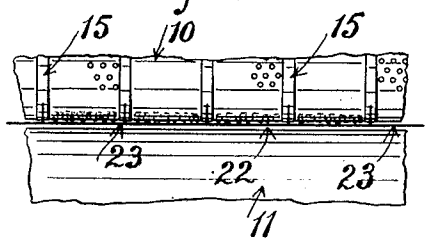



Fig. 6.




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# UNITED STATES PATENT OFFICE

2,071,438

## METHOD OF AND MEANS FOR PRODUCING SLIVERS OR ENDS OF FIBROUS MATERIALS

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Application November 10, 1934, Serial No. 752,412
In Great Britain November 25, 1933

11 Claims. (Cl. 19—89)

This invention relates to a method of and means of producing slivers or ends of fibrous material, as for example from cotton.

According to the method, slivers or ends can be produced from cleaned and well opened cotton conveyed in an air stream, the slivers or ends being produced from the air stream conveyed fibres without the necessity of forming a lap and the need to employ a carding engine as is usual in the preparation system to produce slivers. As a consequence, processes and apparatus of an expensive nature are dispensed with and a product as good as or better than the customary product is obtained in a more direct and easy fashion than is at present the case.

The means relate to apparatus for carrying out the method.

The method and means may be found to be applicable for dealing with mechanically well-opened fibre conveyed in an ordinary air stream, but is more advantageously employed in connection with apparatus making use of "streamline" system of separation and conveyance.

By "streamline" currents as referred to throughout the specification and the appended claims is meant that a streamline air current is one in which there are no eddies except possibly such as are of very small linear dimensions. In such an air current the motion at any point is, for all practical purposes, determinate and steady, so that the motion of an entrained particle carried by it depends merely on the buoyancy of the particle and the characteristics of the current.

Recent developments and methods of opening, cleaning and depositing cotton and other fibrous material have resulted in the obtainment of such a degree of opening and cleaning, that some of the further processing at present considered necessary to obtain the material in sliver or like form may not be necessary, and it is along this direction of thought that our method proposes to travel and be developed by us, as will be later ascertained.

Thus, it is now possible by "streamline" system of treatment, separation from trash, and conveyance, to clean and open cotton so thoroughly in the early processes that the cleaning and opening action of the carding engine may well be no longer necessary, as when used on cotton so cleaned and opened by this recently proposed method, the carding engine mainly operates as an apparatus for producing a sliver.

Our invention concerns a method of producing much more directly slivers or ends of fibrous material and is applicable to cotton which is opened, cleaned and conveyed in an air stream suitably generated and controlled in connection with preliminary opening, cleaning and conveying, but is especially useful with cotton opened, cleaned and conveyed by the above mentioned "streamline" system.

In any event by acting on the opened, cleaned and air stream conveyed cotton in manner hereafter proposed, the process of carding is unnecessary and thereby is effected a considerable reduction in processes and apparatus with attendant economies. The method applied to other fibrous materials than cotton would similarly lessen the amount of processing necessary for the simultaneous production of a number of slivers or the like.

The method also leads to the production of slivers or ends in which the individual fibres are better parallelized than in slivers produced by customary methods, so that even where the loose fibrous material to be dealt with is clean and therefore the question of improved cleaning is not involved, the hereafter described method leads to increased efficiency and economy.

According to the method it is proposed to project the fibrous material, by beater or other means, where necessary, in a finely divided state into a chamber wherein there is a sustained conveying air current and most advantageously a "streamline" air flow is maintained by forward suction or by blowing, and the method is distinguished in that the air flow is subdivided in such a manner that sensibly or roughly equal amounts, or any desired proportions, of material are carried or conveyed by each sub-divided or subsidiary current and thereafter kept separate and distinct as to the slivers or ends. The material so conveyed in the sub-divided current requires to be collected or condensed by means such as cages, or perforated endless bands, or by drums or rollers suitably sub-divided, and to pass the ends of fibrous material thereby obtained forward to drafting mechanism whereby each portion of fibrous material or end is drawn out and has its constituent fibres parallelized.

In the main and divided off air streams, we can adopt or provide means or make arrangements for controlling the degree of vorticity of the current or "streamline" flow, when such is utilized, and such means may include the appropriate shaping of boundary, enclosing and dividing walls, and the use of an aerofoil or aerofoils. The collecting means may consist either of a number of units, one for each separate stream, or a single unit of substantial size, such unit being suitably sectionalized or divided.

Thus, if the collecting means be a pair of cages, or cage and roller, we might utilize a separate cage or pair of cages or cage and roller for each separate stream, or use a single pair of cages perforated as to a series of spaced rings with blank spaces intervening or a single such cage and a roller.

For the purpose of removing the material from the surface of the cages or perforated band or bands, we may adopt any known or appropriate means such as suitably located internal dampers (adjustable or otherwise), rollers, stripping devices operated mechanically or assisted by air currents or the like. For conveying the material to the drafting provision, we make use of any known devices such as rollers, drafting rollers, funnels, spouts, troughs, guiding and confining devices, conveying means, rubbing leathers, or forwarding apparatus. We may make use of means for increasing the cohesion of the fibrous material, such as compressing rollers or twisting devices.

As a means for drafting the fibrous material, we may use any known mechanism adapted to the needs of the particular material which is being processed, such as are used in or form part of drawing frames, gill boxes, English or French worsted drawing frames.

The material after drafting may be collected by any known means for example in cans, or it may be twisted and collected on to bobbins. We may remove the collected material in the cans for further treatment by other apparatus, or we may combine means for doubling and further drafting by processes which continue the treatment of the fibrous material following the above indicated initial drafting.

As one mere example of the application of our method to the treatment of cotton which is to be passed through a settling chamber and which cotton in opened condition is conveyed through a combined opening, cleaning, and conveying apparatus by a "streamline" air current after the method described in the patent specification of U. S. A. application Serial No. 675,550, June 13, 1933, we instance the arrangements and means shown by the accompanying drawings, wherein:—

Fig. 1 is a sectional view of a proposed apparatus.

Fig. 2 is a sectional end view taken on the line A—A from the feed end of the machine.

Fig. 3 shows a sectional view of an alternative form of the apparatus illustrated by Fig. 1.

Figs. 4, 5 and 6 are detail views.

In the drawings, 1, 1 are conveying rollers which conduct the material (say cotton) to be treated to a delivery plate 2 which serves as a guide to feed rollers 3, 3. As shown, these feed rollers consist of a lower roller resting for the whole or portions of its length in cup bearings 4, and an upper roller supported in end bearings and moving in contact with a supporting roller 5 also supported in end bearings. All the rollers are positively driven by gearing and there may be provided additional adjustable weighting means.

The above feed roller system is one considered specially suitable as it allows of small rollers to be used, but any other appropriate roller-feed or dish-feed system may be used. The feed rollers work in conjunction with a rapidly revolving toothed beater 6 which removes the cotton from the feed rollers and projects it in a finely divided condition into the chamber 7, which has an air inlet 8 through which air is drawn by the suction of the fan 9 acting through the cage 10 in known manner, which cage in conjunction with the roller 11 serves to condense the material carried by the air stream and deliver it to the compressor rollers 24 for subsequent processing.

Alternatively in place of the roller 11 we could use a second cage 11*a* with damper, but in this case we should arrange so that the major portion of the air current would be carried through the upper cage 10. Such alternative arrangement is indicated diagrammatically at Fig. 4.

The chamber 7 has a rearward wall 12 and a forward wall 13 extending in the manner shown, to near the cage 10. The side walls of the chamber 7 are formed by the sides of the machine. A streamer plate 14 (of appropriate shape as suggested in Fig. 1) serves to direct the air stream from the surface of the beater 6, and a "streamline" flow is produced in the chamber 7 in manner described in the specification of U. S. A. application Serial No. 675,550, by means of which cleaning is assisted and the cleaned and opened cotton carried forward towards the cage 10.

According to our invention we sub-divide the air stream which may be of an ordinary nature, but preferably is of "streamline" character as aforesaid, and one manner of sub-dividing the air stream is now described. The surface of the cage is divided into sections by means of metal or other rings or bands 15. The region through which the air stream travels on its way from the chamber 7 to the cage 10 is divided in a corresponding manner by means of thin vertical plates 16 into a series of corridors or channels according to the width of the machine or the number of ends to be produced. One of the plates 16 is shown separately at Fig. 5. The plates 16 are approximately tri-angular in general form, but the edges adjacent to the cage 10 are shaped to fit to the metal rings or bands 15, the fit being such as to minimize leakage from one corridor or channel to another and yet to allow free rotation of the cage. The upper sloping edges of the plates 16 are fixed in an adequately air-tight manner to the cover 17. A bar 18 fits across the machine and serves to carry the stripping plate 19. The plates 16 are fitted smoothly into the bar 18 in grooved joints by welding or in other manner, and their lower edges curve smoothly into the lower curved face of the bar 18. The stripping plate 19 with operative edge is adjustable on the upper surface of the bar 18 in such a manner that in all positions its lower face joins smoothly with the lower face of the bar 18.

The cage 10 is provided with a damper such as 20, and if a cage is used in place of the bottom roller 11, as suggested by Fig. 4, said cage is provided with a corresponding damper 20*a*. The plates 16 do not extend round the upper portion of the cage 10 into its dampered region, and the channels are rendered air tight in this region by the boundary wall 21. The upper portion of the cage is suitably encased as suggested at 27, Fig. 1. The dividing plates 16 extend into the region of "nipping" at 22, so far that the separation is maintained slightly beyond where the suction ceases owing to the action of the damper 20. In this region, the edge of the plates 16 is shaped to make a close fit to the roller 11 or cage 11*a*. Shaped auxiliary troughs 23 may be fixed to the plates 16 to maintain the separation

of the ends until the material reaches the compressing rollers **24**.

The action of the illustrated apparatus is as follows: A "streamline" air flow carrying finely divided cotton and liberated trash is produced in the chamber **7**, and the air flow is adjusted so that the cotton and fine dust are carried forward and the trash deposited. The stream of air and fibre is divided by the plates **16**, and the sub-divided or resulting subsidiary streams travel forward until each meets the corresponding perforated section of the cage **10** with its peripheral divisions **15**. The air and fine dust pass through the cage perforations and the cotton is condensed by the cage **10** and roller **11**, Fig. 1, (or by cages **10** and **11a** according to Fig. 4), into the form of a number of separate narrow strips or ends.

Fig. 3 suggests an alternative form of the chamber **7** in which the forward wall **13** is arranged differently. This arrangement also ensures a "streamline" flow in accordance with the specification of U. S. A. application Serial No. 675,550, and in which a more critical separation of trash is possible than according to Fig. 1, owing to the greater degree of flatness of the "streamlines". To counteract the tendency towards instability of flow owing to the now greater width of the ascending air stream, we can introduce a bar **26** whose section is of aerofoil shape.

Our experiments have shown that the narrow fibrous strips or ends obtained in manner described can be processed further by known machinery so as to yield a product equal or superior to that hitherto produced in a much more elaborate and costly manner. Thus with cotton the strips or ends produced may be passed direct from the compressor rollers **24** to a set of heads of drawing rollers **25** so as to form a set of slivers. It is found that slivers thus produced are at least as good, as regards cleanliness, freedom from nep, and fibre parallelization, as the products of ordinary draw-frames, where the cotton has been formed into an ordinary lap at two stages, has then been carded and the card sliver passed through two heads of drawing mechanism.

We claim:

1. In apparatus for the purpose described, a horizontal beater revolving from rear to front in its lower segment, a plate of tear-drop cross-section arranged close beneath the rearward part of the lower segment with the sharp edge of the plate rearward, feeding means to feed fibres against the rearward segment of the beater above the plate, a casing below said beater and closed at its lower part to provide a trash receptacle, said casing having a rearward wall arranged to permit air flowing into the casing to move toward the beater between the feeding means and plate, a stripper plate for said beater cooperating with the beater on its front segment, vertical partitions arranged in spaced relation and extending forwardly from the stripper plate, housing plates above and below the partitions, said housing plates comprising a cover plate above the partitions and a plate extending from the front wall of the casing forwardly below said plates, cylinders forming a feeder at the front of said partitions, one of said cylinders being perforated to form a suction cylinder, pairs of rings on the perforated cylinder forming grooves receiving edges of the partitions, and means to provide a partial vacuum in said perforated cylinders, said partitions fitting closely to said perforated cylinders.

2. In apparatus for the purpose described, a horizontal beater revolving from rear to front in its lower segment, a plate of tear-drop cross-section arranged close beneath the rearward part of the lower segment with the sharp edge of the plate rearward, feeding means to feed fibres against the rearward segment of the beater above the plate, a casing below said beater and closed at its lower part to provide a trash receptacle, said casing having a rearward wall arranged to permit air flowing into the casing to move toward the beater between the feeding means and plate, a stripper plate for said beater cooperating with the beater on its front segment, vertical partitions arranged in spaced relation and extending forwardly from the stripper plate, housing plates above and below the partitions, said housing plates comprising a cover plate above the partitions and a plate extending from the front wall of the casing forwardly below said plates, cylinders forming a feeder at the front of said partitions, one of said cylinders being perforated to form a suction cylinder, pairs of rings on the perforated cylinder forming grooves receiving edges of the partitions, and means to provide a partial vacuum in said perforated cylinders, said partitions fitting closely to said perforated cylinders, and a transversely curved plate stream-lined in cross-section and extended across the casing in spaced relation to the beater and below the front thereof.

3. An improved method of producing slivers, strips and ends of cotton and other fibrous material, according to which well-opened fibrous material is projected into an undivided air stream passing over an air space and is conveyed a considerable distance in said air stream while the stream is undivided and while supported only by said air stream to allow the fibrous material to become more evenly distributed and to allow the trash to fall out in said air space, the said air stream being subsequently sub-divided on the forward side of and after travelling over the said air space, and following discharge of the trash, the opened and cleaned fibre being conveyed in definite and separate channels in spaced relationship, the fibre from these separate channels being separately collected into slivers, strips and ends, and further acted upon to deliver same.

4. An improved method of producing slivers, strips, and ends of cotton and other fibrous material, according to which fibrous material is opened and is then conveyed by an induced and undivided air stream over an air space by forward movement of sad air stream, the opened material being solely supported by said air stream while the latter is undivided, the fibrous material distributing itself during its conveyance through the undivided air stream and the trash falling out into the air space, the air stream supporting the fibrous material being divided on the forward side of and after travelling over the air space and the cleaned fibre in the air stream being sub-divided and conveyed in definite and separate channels in spaced relationship and adjacent the forward side of the air space, the fibres in said sub-divided stream being separately collected as slivers, strips and ends and delivered.

5. An improved method of producing slivers, strips, and ends of cotton or other fibrous material, according to which a mass of fibre is fed forward and acted upon to open the mass and the well opened fibrous material is projected into a forwardly moving undivided air stream, and then passes over an air space, wherein the opened fibres are evenly distributed and the trash falls and after passing over said air space the

air stream is divided the moving air stream forming the sole means for supporting and conveying the opened fibres so that the air stream and fibres are conveyed in definite and separate channels in spaced relationship after passing over the air space and are separately collected and delivered in the form of slivers, strips or ends.

6. An improved method of producing slivers, strips, and ends of cotton or other fibrous materials, according to which well-opened fibrous material is projected into a forwardly moving undivided streamline air current, the fibrous material being supported solely by said streamline current and conveyed so as to travel over an air space whereby the fibre is evenly distributed and the trash falls into said air space, the air stream conveying the fibre being divided immediately forward of said air space whereby the air stream is divided and along with the entrained fibre is conveyed in seperate and distinct channels and is collected and delivered in separate slivers and ends.

7. Apparatus for cleaning fibrous material and producing separate ends comprising feed mechanism, a beater contrivance cooperating therewith and adapted to open the fibrous material, a chamber below said beater contrivance having an undivided air space, means for producing a forwardly moving air current to convey the opened fibre over the undivided air space, a stripper cooperating with the beater, dividing plates adjacent the forward side of the beater contrivance to provide separate channels succeeding the undivided air space to divide the forwardly moving current of air and to convey the opened fibre, cage means to collect the fibre, and rings on the cage cooperating with the dividing plates to ensure the delivery of separate slivers and ends from the separate streams.

8. Apparatus for cleaning fibrous material comprising feed mechanism, a beater contrivance cooperating therewith, a chamber below said beater contrivance providing an undivided air space and provided with walls shaped so as to afford smooth guidance to the air stream, streamer plate means in connection with the beater contrivance, arrangements for producing a streamline air current to convey the opened fibre through the apparatus and over the undivided air space, a stripper cooperating with the beater contrivance, dividing plates adjacent the forward side of the undivided air space, to which the fibre is conducted over the undivided air space, said plates providing separate channels into which the well-opened and cleaned fibres are conveyed whereby the air stream and the fibre is conveyed in separate channels, cage means to receive the fibres, and rings on the cage to cooperate with the dividing plates to ensure separate delivery of the fibres from the separate channels.

9. Apparatus for cleaning fibrous material comprising feed mechanism including feed rollers, a beater contrivance, a streamer plate in connection with said beater and serving to deflect smoothly the stream of air and fibrous material from its surface, an open undivided air chamber below said streamer plate, means to produce an air stream to convey the fibrous material projected across the upper part of the undivided air chamber to convey the fibre and permit same to evenly distribute itself and allow the trash to fall into said chamber, a stripping plate cooperating with the beater contrivance, dividing plates located at the front side of the undivided air space to divide the air stream and the fibres conveyed, and a suction cage having rings extending around the cage and cooperating with the dividing plates to maintain separation of the air stream and fibres, and conveying rollers to receive the fibres from the divided air stream.

10. The improved method of cleaning fibres in a mass of loose beaten fibrous material which consists in providing an unobstructed streamline air current having a path provided with a well defined downward dip intermediate of the terminals of the path and an undivided air space, and wherein a quantity of loose fibres and trash is projected into the streamline current adjacent its supply end and in advance of the downwardly dipping part of the streamline current, dividing said current into divisions at the forward side of the undivided air space, maintaining said divisions, collecting and condensing the fibres to allow the escape of the air current carrying forward the divided portions of the fibres entrained, and collecting them as slivers and ends, and delivering same.

11. Apparatus for cleaning fibrous material, comprising feed mechanism, a beater contrivance cooperating therewith to open the fibrous material, a chamber below the said beater contrivance and extending rearwardly of it, said chamber providing an undivided air space, means for producing a forwardly moving air current to convey the opened fibre through the upper part of undivided air space, a stripper cooperating with the beater contrivance, dividing plates adjacent the forward side of the undivided air space and forward of the beater and stripper and located above the forward portion of the chamber and having lower edges inclined at a small angle to the direction of the air stream to conduct the fibre into separate channels anterior to the undivided air space, cage means for collecting the fibres from the separate channels, and rings on the cage means cooperating with the edges of the dividing plates to ensure the separate delivery of the fibres from the separate streams.

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