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COMBING MACHINES FOR WOOL AND OTHER TEXTILE FIBRES

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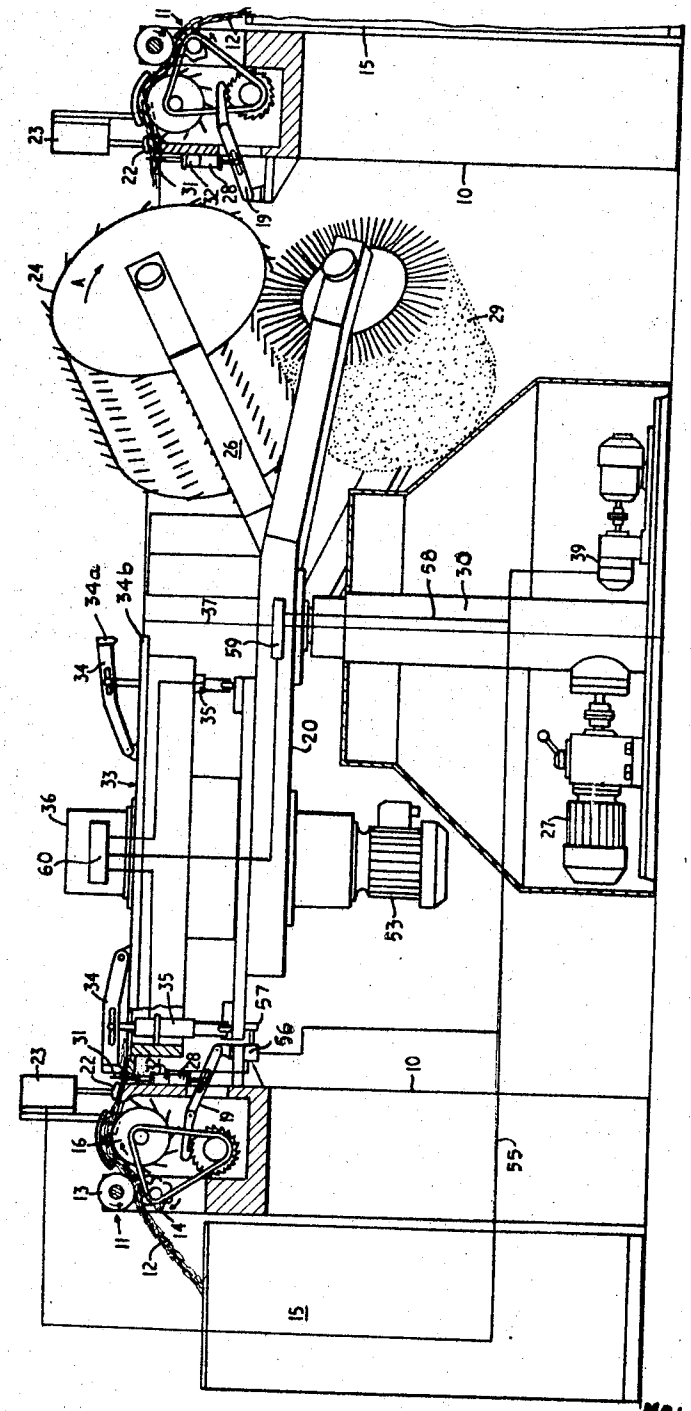
FIG. 1

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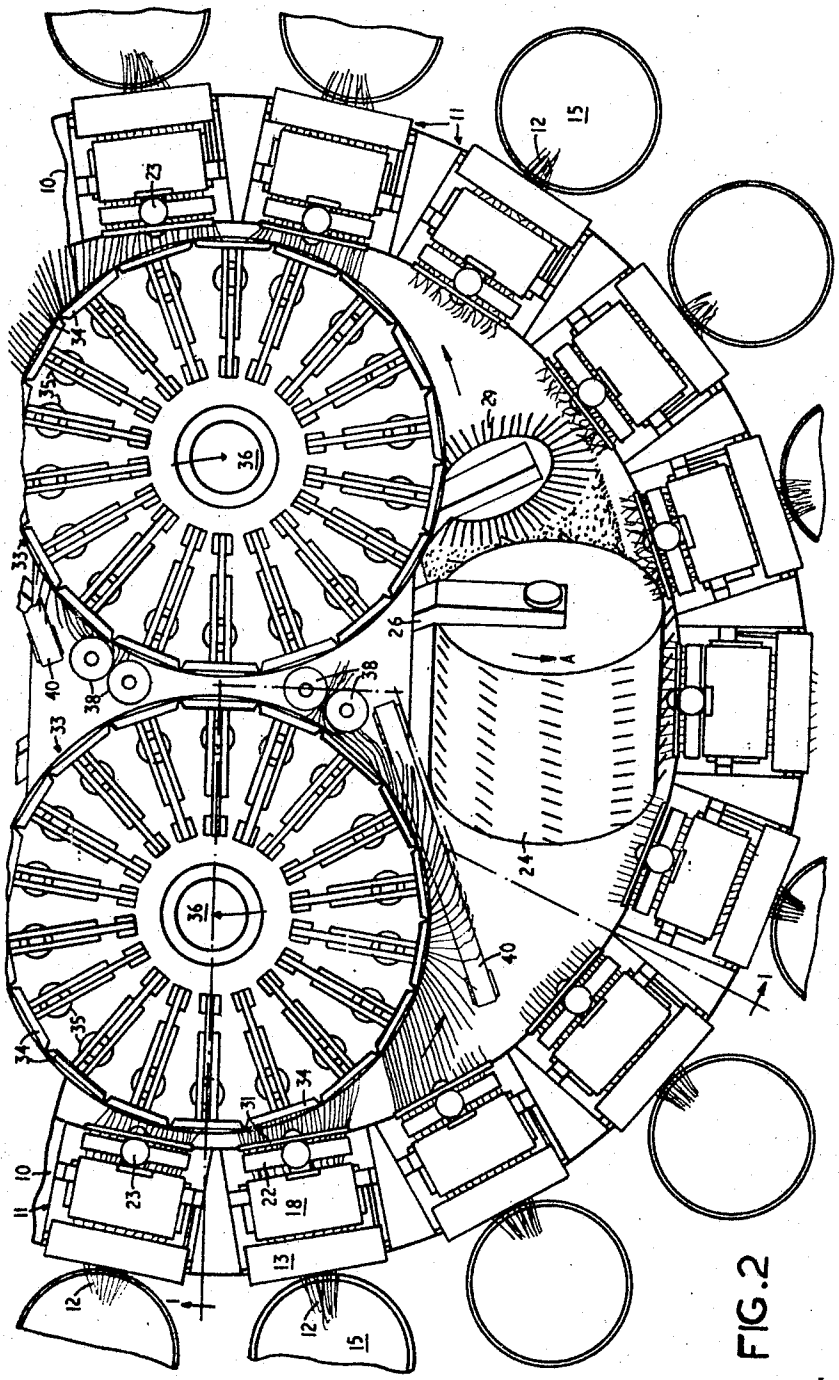

FIG. 2

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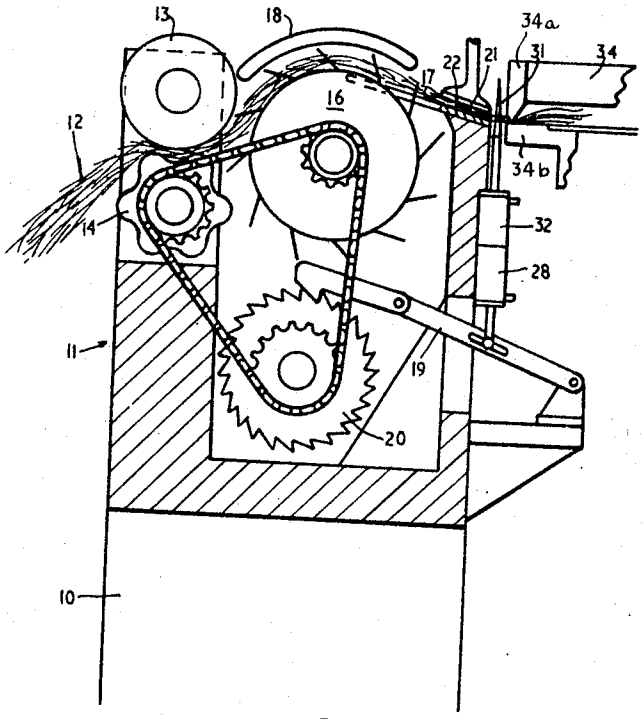


FIG.3

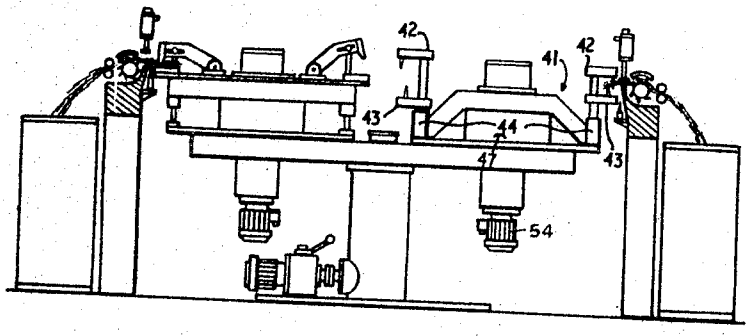


FIG.4

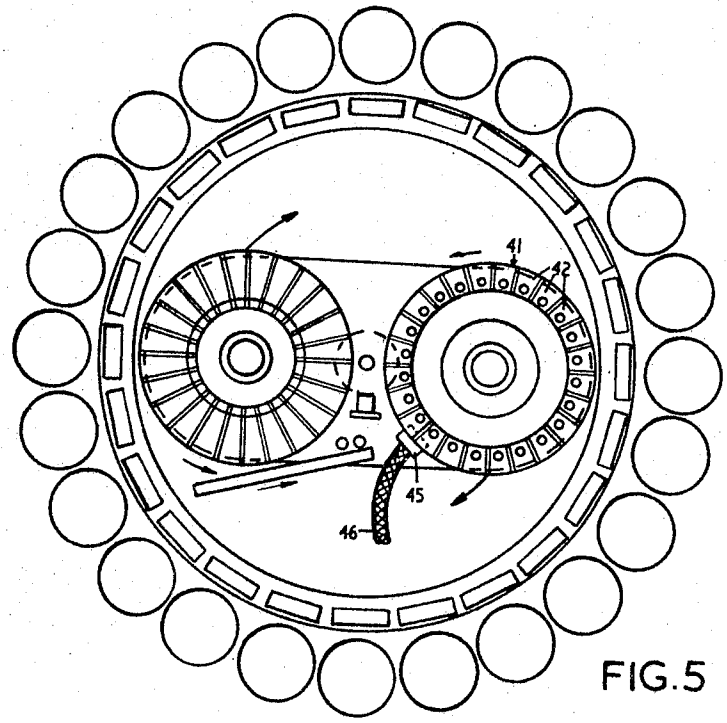


FIG.5

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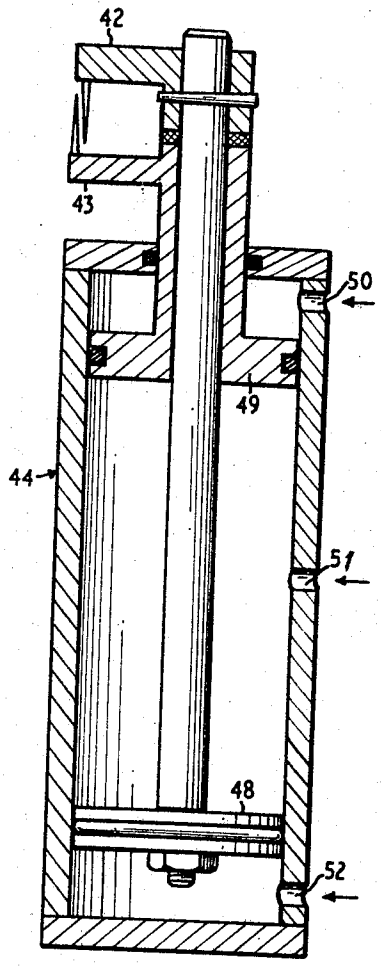


FIG. 6

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3,445,896

# COMBING MACHINES FOR WOOL AND OTHER TEXTILE FIBRES

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7 Claims

## ABSTRACT OF THE DISCLOSURE

A combing machine is formed of a plurality of feeding mechanisms disposed in an annular arrangement with the means for drawing and combing the fibres disposed inwardly from the feed mechanisms. Initially, a combing means is provided to rotate relative to the feeding means combing the forward ends of the fibres. Then clamping and withdrawing means including other combing means are provided for drawing the fibres radially inward and combing them as they are removed from the feed mechanisms.

The present invention relates to a combing machine for textile fibres and its object is to provide a combing machine which will operate smoothly and at high speed while producing a product of good quality.

While the invention may be applied to machines for combing a wide variety of fibres, it will for convenience be described in connection with the combing of wool. At present wool is combed mainly by the use of either the rectilinear comb or the noble comb. The former, while producing a particularly efficient combing action involves the use of a great many reciprocating and intermittent movements and the latter, while utilising a rotary motion involves mechanisms which place a very substantial limit on the speed of working.

The present invention provides a machine which among other things incorporates the more desirable features of the machines mentioned above in providing the efficient combing action of the rectilinear comb and the continuous method of working of the noble comb.

The invention consists in a combing machine for combing textile fibres, having a plurality of feeding mechanisms arranged to feed forward intermittently a plurality of slivers of fibres to be combed, said feeding mechanisms being arranged around the circumference of a feed circle, a rotating comb means constructed and arranged to comb the forward ends of slivers fed forward by the feeding mechanisms, means to produce relative rotational movement about the centre of said circle between the said rotating comb means and the feeding mechanisms whereby the ends of the slivers are continuously combed in turn, clamping means to clamp each sliver adjacent its forward end on said feed circle, while the forward end is being combed, drawing-off means arranged to grip the combed forward ends of each sliver in turn and to draw-off from the sliver the fibres gripped, the drawing-off means having a rotational movement about the centre of said circle relative to the feeding mechanisms, a comb arranged adjacent each said feeding mechanism, means to move each such comb into the combed ends of the sliver adjacent said gripping means whereby the remaining rear portions of the fibres drawn-off by said withdrawing means are combed while being drawn-off and means to take up



combed fibres from said drawing-off means and form them into a sliver or slivers.

It is preferred to maintain the circle of feeding mechanisms stationary and to rotate the rotating comb means and the drawing-off means about the centre of the circle.

In order that the invention may be better understood and put into practice preferred embodiments thereof are hereinafter described by way of example with reference to the accompanying diagrammatic drawings in which:

FIG. 1 is a part sectional elevation of apparatus according to the invention on line I—I of FIG. 2.

FIG. 2 is a plan view of the major part of the apparatus shown in FIG. 1.

FIG. 3 is a view to an enlarged scale of part of the mechanism of FIG. 1.

FIG. 4 is a part sectional elevation of another form of the invention having a modified rotating comb means.

FIG. 5 is a plan view of the apparatus shown in FIG. 4.

FIG. 6 is a view to an enlarged scale illustrating a detail of the construction.

In the preferred form the combining machine consists of a circular base **10**, around which are evenly spaced a number of feeding mechanisms **11**, for example eighteen, one of which is shown to an enlarged scale in FIG. 3 to feed forward a similar number of slivers **12** intermittently in a radially inward direction, see FIG. 2. Each feeding mechanism consists of a pair of feed rollers **13** and **14** which act to draw a sliver **12** from a sliver can **15** placed below the rollers and to flatten out the sliver and feed it to a fully pinned porcupine roller **16**. The porcupine roller **16**, in conjunction with a stripping plate **17** and a guide plate **18**, feeds the sliver forward to a substantially horizontal continuous annular surface **21** placed radially inward of the porcupine roller **16**; this surface **21** contains the nip line for the end of the slivers **12** projecting from the porcupine rollers **16** and constitutes the feed circle for the machine having a vertical axis **37**. Feeding mechanisms **11** are arranged in such a manner that in operation the surface **21** is covered with a uniform layer of fibres, the forward ends of which project radially inwardly beyond the nip line for a distance of, for example 1", the projecting ends of the fibres being thus freely accessible for combing. The motion of the feeding mechanisms **11** is intermittent and adjustable to feed a predetermined length of fibres for each combing action.

Motion of the feeding mechanisms **11** may be produced in a variety of ways one of which is illustrated and is best seen in FIG. 3. In this arrangement an intermittent motion is produced by the action of the composite layer **19** the hooked end of which engages the teeth of the ratchet wheel **20**, the lever **19** being operated by the hydraulic jack **28**, which is actuated by a hydraulic distributing mechanism referred to below, so that each jack **28** around the feed circle is actuated in turn at the right time to cause each feeding mechanism to feed forward a predetermined length of a sliver **12**.

The inwardly projecting ends of the fibres are clamped along the nip line during combing by means of a plurality of nipper jaws **22** pressed against the surface **21** by a series of hydraulic cylinders **23** arranged above the surface **21**. Only two of the cylinders **23** are shown in FIG. 1 for clarity.

Combing of the projecting ends of the fibres is carried out by rotating comb means consisting of two fully pinned cylinders **24** each of which is mounted for rotation about its principal axis and which is continually rotated about that axis in the direction of the arrows A by suitable driving means (not shown). Each combining cylinder **24** is supported on a radial arm **26** extending from a rotating table **20** supported from a pivot at the centre of the circular base **10**, the arrangement being such that each cylin-

der **24**, while rotating on its own axis is also rotated about the vertical axis **37** of the feed circle by the main drive motor **27**. The effect of this is that as each cylinder **24** is moved in a circular path it combs the projecting ends of the fibres continuously during its movement around the inner edge of the annular surface **21**, the fibres of each sliver being combed in turn.

In view of the rotation of each combing cylinder **24** about two axes it is convenient to arrange the axis of the cylinder so that it lies at an angle to the plane of the circle containing the annular surface **21** as is indicated in FIG. 1. This satisfies two requirements:

(1) The horizontal section of the cylinder **24** is an ellipse and portion of it will be concurrent with the feed circle for all practical purposes, eliminating the expense and difficulties of manufacturing and pinning a more complex solid of rotation, which would precisely fit the feed circle.

(2) The movement of the pins is governed by two velocity vectors. If the magnitudes of these vectors are selected properly, the resultant vector at the moment of combing will be—with little deviation—vertical. Furthermore by altering the magnitude of one of the vectors with respect to the other, the alignment of the fibres projecting from the nip circle can be changed. This latter characteristic may be useful to increase the efficiency of the drawing-off.

Movement of the combing cylinders **24** around the feed circle is synchronised with movement of the nipper jaws **22** so that as the ends of fibres are being combed they are also gripped along the nip line. A rotating brush **29** is provided to operate in conjunction with each combing cylinder **24** to remove short fibres, neps and burrs from the pins of the combing cylinder.

Once the forward ends of the fibres of a sliver have been combed by one of the combing cylinders it is necessary to draw-off those fibres from the body of the sliver **12** while simultaneously combing the remaining rear portion of the fibres. This is done by providing a rotating drawing-off mechanism which may take a number of forms, one of which is described in detail below. Any such drawing-off mechanism acts to grip the free forward ends of a group of fibres and to draw them inwardly preferably in a radial direction. In order to comb the remaining rear portion of the fibres a number of back combs or filter combs **31** are provided on the inner surface of the feed circle. A hydraulic cylinder **32** is provided to move the filter comb **31** associated with the fibres of each sliver **12** and this acts to move the filter comb **31** upwardly so that its pins penetrate the fibres just inwardly of the feed circle. The filter comb **31** is subsequently withdrawn after completion of the drawing-off operation.

In the present embodiment of the invention the drawing-off mechanism consists of a pair of detaching rings **33** made up of a plurality of detaching clamps **34**, each ring being rotated by electric motor **53**. Each clamp **34** is actuated by a hydraulic cylinder **35**. By appropriate synchronisation of the rotation of the detaching ring **33** about the hub **36** and the rotation of the hub **36** about the vertical axis **37** of the feed circle the clamps **34** can be caused to clamp the forward ends of a quantity of fibres projecting from the nip line of the feed circle **21**, the fibres being clamped between the pivotally movable head **34***a* of the clamp **34** and the flange **34***b* (see FIG. 3), and draw the fibres radially inwardly towards the axis **37** of the feed circle. As each fibre is withdrawn the clamped end of it follows a path which is a hypocycloid. By choosing the diameter of the detaching ring **33** to be approximately half the diameter of the feed circle and by appropriate choice of the speeds of rotation the hypocycloid is approximately a straight line which is also approximately radial to the feed circle.

With this arrangement the fibres are drawn off substantially in the same straight line as the end of the sliver **12** and no substantial change of direction of the fibre takes place during the drawing-off process. After the drawing-off operation each sliver **12** is automatically advanced by the feeding mechanisms **11** ready for the next combing action.



Once the fibres have been completely drawn-off from the sliver they are carried around by the clamps **34** of the detaching rings **33** to a point near the axis **37** of the feed circle where they are taken up and formed into a sliver by one of the pairs of rollers **38** and a rotating funnel and coiler not shown on the drawing.

The hydraulic cylinders **23**, **28**, **32** and **35** are operated by hydraulic fluid supplied by a gear pump **39**, distributed by a suitable hydraulic circuit and hydraulic fluid distributors contained in the hubs **36**. Hydraulic lines **55** are taken from gear pump **39** to cylinders **23**, **28** and **32** via cam operated valves **56**, one or two for each cylinder as required, the valves being fixed to the circular base **10** and the valve cams **57** being attached to the periphery of the table **20**, the arrangement being such that the valves **56** are actuated in sequence by the cams. Cylinders **35** are actuated by hydraulic lines **58** from the pump **39** passing through the hollow central shaft **30** to a swivel point **59** at the centre of table **20** from which a hydraulic line passes to the hydraulic distributor **60** in hub **36**. The hydraulic circuitry has been shown schematically in the interest of portraying the invention clearly in the drawing and because the arrangement of the hydraulic circuitry is not an essential element of the invention. Whilst moving towards the rollers **38** the ends of the fibres are turned towards them for more efficient collection by means of a transfer belt **40**.

The apparatus described above is equally adaptable to the combing of all types of textile fibres, such as cotton and wool, with modification of details such as pinning of the cylinder **24** to obtain optimum results with a particular type of fibre. While in the apparatus described two combing cylinders **24** and two drawing-off devices are described it will be readily appreciated that 1, 2, 3, 4 or more of these devices may be included within the feed circle for optimum economy.

FIGS. 4 and 5 show an embodiment of the invention which is the same in general construction as that described above but differs from it in the use of a different rotating comb means. The comb cylinders **24** of FIG. 1 are replaced by another form of pinned rotating comb assembly **41** that is rotated by electric motor **54** and consists of a number of upper pinned segments **42** and lower pinned segments **43** which are actuated to open or close as a pair by the hydraulic cylinder **44**. Each of the segments **42** and **43** carries one or more rows of pins projecting from that segment towards the other segment of the pair. The rows of pins are placed so that they overlap without touching each other when the segments are closed. Each pair of pinned segments is made to close at a point where they are closest to the feed circle as shown on the righthand side of FIG. 4, thus causing the pins to penetrate the projecting fringe of fibres.

FIG. 6 shows the manner in which the segments **42** and **43** are actuated to open and close by cylinder **44**. The cylinder **44** contains two pistons **48** and **49**, the former being connected to segment **42** and the latter to segment **43** in the manner shown. Ports **50**, **51** and **52** permit hydraulic fluid to be admitted to or to leave the cylinder **44** and as can be readily seen the admission of fluid to port **51** and its return through ports **50** and **52** will cause the segments **42** and **43** to close. Flow of fluid in the opposite sense will cause the segments to open.

The combing assembly **41** rotates about its centre, and also about the centre of the feed circle in the same way as the drawing-off rings **33**. As the assembly **41** rotates the forward ends of the fibres are combed by the pins, and the noil consisting of short fibres, neps and other impurities is removed from the pins when the segments have opened by air jets **45** which transfer the noil to a collecting suction tube **46** which transports it to a con-

tainer external to the combining machine. The point in rotation of the assembly 41 at which each pair of segments closes and opens is controlled by a hydraulic distributor 47.

The embodiments of the invention described above are given by way of example only to assist in an understanding of the invention and is one of a number of forms of the invention which may be constructed within the broad scope thereof.

We claim:

1. A combing machine for combing textile fibres comprising a plurality of feeding mechanisms disposed in an annular arrangement about an axis and forming a feed circle about the inner periphery of the annularly arranged said feeding mechanisms, said feeding mechanisms arranged to feed intermittently a plurality of slivers of fibres to be combed inwardly into the feed circle, a rotating comb means located within the feed circle and arranged to comb the forward ends of slivers fed inwardly by said feeding mechanisms, means to produce relative rotational movement about the axis of the feed circle between the said rotating comb means and said feeding mechanisms whereby the forward ends of the slivers of fibres fed inwardly by each of said feed mechanism are combed in turn, clamping means to clamp each sliver adjacent its forward end adjacent the inner periphery of the annular arrangement of said feed mechanisms, drawing-off means arranged to clamp the combed forward ends of each sliver in turn and to draw-off from the sliver the fibres clamped, the drawing-off means having a rotational movement relative to said feeding mechanisms, a comb arranged adjacent and inwardly from each said feeding mechanism, means to move each said comb into the combed forward ends of the sliver whereby the remaining portions of the fibres rearwardly of the combed forward ends are drawn-off by said drawing-off means and are combed while being drawn-off, and means to take up combed fibres from said drawing-off means.

2. Apparatus as claimed in claim 1, wherein said feeding mechanisms are stationary and said feeding mechanisms are arranged to feed the forward ends of the slivers radially inwards towards the centre of the feed circle.

3. Apparatus as claimed in claim 2, wherein said drawing-off mechanism comprises a plurality of fibre clamping means disposed in an annular arrangement and the circumferential periphery thereof forming a second circle lying substantially in the same plane as and within said feed circle, means to rotate said fibre clamping means about an axis passing through the centre of said second circle, means for closing said clamping means about the combed forward ends of the fibres of a sliver at a point



inwardly adjacent the circumference of the feed circle, and means to open said clamping means to release said fibres after they have been drawn-off, the peripheral speed and direction of rotation of said clamping means on said second circle being such that the fibres are drawn-off from said feeding mechanisms along a hypocyloidal path.

4. Apparatus as claimed in claim 3, wherein the diameter of the said second circle is of the order of half the diameter of the feed circle whereby fibres are drawn off in a substantially radial direction toward the centre of the feed circle.

5. Apparatus as claimed in claim 3, wherein said clamping means comprises a ring member, a plurality of clamps each mounted for pivoting about a horizontal axis and arranged around the circumference of said member, a hydraulic cylinder operatively attached to each said clamp to clamp fibres against the upper surface of said ring and subsequently to release them and hydraulic distributing means for sequentially actuating said hydraulic cylinders.

6. Apparatus as claimed in claim 1, wherein said rotating comb means comprises a pinned cylinder arranged to rotate about its axis, the axis of said cylinder being inclined to the plane of the feed circle so that relative motion between the pins of the cylinder and the fibres being combed is in a plane perpendicular to the plane of the feed circle and radial thereto.

7. Apparatus as claimed in claim 1, wherein said rotating comb means comprises a plurality of upper and lower oppositely disposed pinned segments disposed in an annular arrangement and the circumferential periphery forming a second circle lying substantially in the same plane as and within said feed circle, means to rotate said rotating comb means about an axis passing through the centre of said second circle, means for closing each pair of upper and lower pinned segments sequentially at a point adjacent the circumference of the feed circle to penetrate the forward ends of the sliver in turn, and means to separate said segments after the ends of the slivers have been combed, the peripheral speed and direction of rotation of said pinned segments being such that the ends of the slivers are combed in a directiton substantially radial to the centre of the feed circle.

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