

(19)



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) Publication number:

0 222 532 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: **11.03.92** (51) Int. Cl.⁵: **D01B 5/06**

(21) Application number: **86308173.3**

(22) Date of filing: **21.10.86**

(54) **Hackling or combing of fibres.**

(30) Priority: **05.11.85 GB 8527226**

(43) Date of publication of application:
20.05.87 Bulletin 87/21

(45) Publication of the grant of the patent:
11.03.92 Bulletin 92/11

(84) Designated Contracting States:
BE FR GB IT

(56) References cited:
DE-C- 479 034
DE-C- 511 405
DE-C- 514 761
DE-C- 567 294
US-A- 3 141 198

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EP 0 222 532 B1

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Description

This invention relates to the combing of fibres, particularly the hackling of fibres such as flax and will be described in terms of the treatment of flax, although the invention is equally applicable to the combing of other fibres. As a preliminary, the scutched flax is divided into bundles or so-called "pieces" which are fed to a hackling machine. The operation of such machines has been well known for many years, and is described in detail in, for example, *The Foundations of Spinning Technology* by W. E. Moreton, published by Longmans Green & Company in 1937.

As described in more detail in this book, the bundles of flax are suspended from holders which are mechanically moved along a channel extending the length of the machine, this channel itself being mounted to reciprocate in a vertical direction to lower the bundles between opposed arrays of pins mounted upon endless sheets. One sheet moves clockwise and the other anti-clockwise, so that their respective hackle pins comb the bundles in a downward direction and remove the shorter fibres (the tow) from the bundle. Each bundle is combed as it moves downwardly between the sheets in the same direction of travel as the hackle pins; it then dwells for a period at the bottom of the stroke while still undergoing combing and it then receives further combing as it is pulled up through the pins in the opposite direction to their travel as the channel supporting the holders is raised to its upper position to lift the bundles out of the sheets. The holders are then advanced one position, i.e. to the next arrays of pins which are more densely pinned, and the cycle repeated.

Each bundle of flax is normally in the region of one to one and a half metres long and is clamped approximately half-way along its length so that in the raised position, the height of the channel must be in the region of eight feet (2.5 metres) from the ground. The machine is thus a large one of which the length can be about forty feet (13 metres), the hackling section itself being in the region of twenty five feet (8 metres) in length. The revolving hackling sheets are in a fixed position.

As described in more detail in the book referred to above, the machine is double sided, the bundles of flax are clamped approximately half-way along their length in the holders at one end of the machine and the holders lowered and raised so as to cause the opposing sets of hackles to comb out the tow from the bundle and leave the higher quality "line" fibres held in the holder. After each complete vertical reciprocation of the holder it is automatically moved one position along the supporting channel and the hackling cycle repeated. The coarseness and pitch of the hackling pins

become finer lengthwise on each side of the machine from the feed end and when each successive holder reaches the other end, the holder is reversed and the position of the flax within the holder re-adjusted ("pulled through") so that on the reverse travel down the opposite side of the machine the other end of each bundle including the section which had been gripped in the holder, is combed.

A traditional construction of hackling machine is illustrated in Figures 1 and 2 of the accompanying drawings, which are respectively a partial side elevation and an end view showing the raised position of the channel with the lowered or operative position shown in dotted lines.

Figure 1 shows a number of holders 4 disposed lengthwise of the machine, each with its bundle of fibres 6. As seen in Figure 2, the holders 4 are located in a channel 8 by means of pairs of studs 9 for movement along the channel under the control of a dog mechanism within the channel (not shown). The channel, in turn, is mounted on chains or straps 10 passing over wheels 12 driven to lower and raise the channel. At the opposite end of the straps are counter-balancing weights 14 to assist the raising of the channel.

Each holder 4 is in the form of opposed clamping plates held together by bolts 15 and, when inserted, the bundles are evenly spread across their respective plates. The machine is double sided, the arrangement as illustrated being duplicated on each side.

As can be seen from the drawings, each bundle is clamped approximately half-way along its length during the first passage so that when lowered, approximately forty percent of its length, normally the root end, is combed. When the holder is inverted so as to be supported by the alternative pair of pins 9 the clamp bolts are slackened and the piece is pulled further through the holder in the opposite direction to that part which has been combed so that when the top is being combed, all that part of the bundle which was not subjected to the combing during the first passage, is combed during the return passage.

Directly below the channel 8 are endless sheets which comprise a number of endless belts 16 across which are mounted successive tie bars 7 which are pitched right around the supporting belts. These bars 7 carry the pinned hackle bars 17 and there may for example, be thirty such bars around the circumference of the belts 16 at a pitch of just over two inches (50 mm). The hackle pins at one side become increasingly finer and more closely pitched as the holders progressively move along the machine, at the end of which the holders are reversed on the bend, and the pin pattern is repeated, starting coarse at the reversal end and being more densely pitched and finer as the hold-

ers return down the other side. The settings of the projecting points of the opposing pins, the overlap, if desired, the progressive fineness and density of the pins are determined to suit the quality of the material to be processed. The belts 16 pass around upper and lower rollers 18 and 19 respectively so as to define substantially vertical working reaches along which the fibres are hackled or combed and which diverge slightly towards the bottom.

As seen in Figure 1, the bars 7 span four belts 16 and are riveted to the belts at 28. On its side adjacent the belts 16 each tie bar has a number of projecting lugs 20 for supporting the hackle bars 17, only the upper of the two tie bars shown in Figure 1 having its hackle bars in position, there being a total of seven hackle bars 17 over the length of each tie bar. The hackle pins are shown only in the two left hand hackle bars, but as already described the fineness of the pinning increases along the length of the tie bars. As a result of the construction just described, tie bars 7 and hackle bars 17 alternate around the circumference of the belts 16 as can be seen in Figure 2.

The amount of hackling which the material receives varies with the number of lifts of head and the revolutions of belt per minute. By increasing the speed of the belts, the amount of work given to the material is thereby increased. An increase in the number of lifts of head per minute, the speed of the belts remaining unchanged, results in a reduction of the amount of work given to the material, but the strain on the material is increased thereby, owing to the alteration in the rate of hackling.

The speed of the head and the channels normally varies between six and ten lifts per minute and the belts 16 between eight and fifteen revolutions per minute, according to the material being worked. The aim is to drive the belts at a speed which will give maximum yield consistent with the cut and the cleanness of fibre. The function of pins in hackling machines is generally defined as that of opening, splitting and cleaning of fibre, the opening up of the bundle being accomplished by the coarse pins, the cutting by the medium pins and the cleaning by the fine pins.

The tow which is combed from the bundles is removed from the hackle pins by brushes 22 and from the brushes by pinned stripping rollers 23. The rollers 23 are cleaned in their turn by doffing knives 24 and the tow 25 finally falls into bins 26.

The full line position of Figure 2 shows the channel 8 in its raised position in which the bundles of flax 6 are lifted clear of the belts 16. The dotted line position illustrates the channel 8' in its lowered position in which the fibres are being hackled. At this lower position the channel will dwell for just a little more than a second before being raised

again.

Further details of the normal construction of the sheets and the associated pinning are to be found in "The Mechanics of Flax Spinning" by Vernon Pringle, published by H. R. Carter Publications Ltd. in 1951.

As previously pointed out, in order to provide an adequate length of working reach for combing the fibres and for raising each bundle of flax above the top of the sheets, the height of the channel in its raised position and hence the overall height of the machine is about 2.5 m; this, in combination with the lengths already referred to, gives a very large, cumbersome machine.

GB-A-0304252 (DE-C-511405) describes a hackling machine comprising co-operating arrays of pins which are driven around closed paths to form a substantially vertical working reach over which the pins in the arrays are opposed as they move in a downward direction alongside one another, in order to comb a bundle of fibres located in the gap between them; means for moving a bundle of fibres into the zone of the working reach; and means for periodically adjusting the spacing between the arrays of pins in the working reach.

According to the present invention, combing mechanism of the type described in GB-A-0304252 is modified in that either or each array is pivotable, and the spacing between the arrays is adjusted by pivoting them in such a way that the pins of the opposed arrays progressively leave the bundle of fibres from top-to-bottom over the working reach when moving apart, and enter the bundle from bottom-to-top when moving together.

In use of apparatus according to the present invention, the spacing between the arrays of pins can be increased at a time when there are no fibres present. When the bundle of fibres has been moved into the working reach, the pins move together again until they reach their normal operating positions, the combing action thus being started in a gradual and relatively gentle manner which contrasts favourably with the operation of previous constructions of such mechanism where the fibres were engaged abruptly by fully intermeshed pins, leading to an inevitable tearing action. The much gentler effect achieved in accordance with the present invention is found to lead to a marked improvement in the overall quality of the resultant product.

This improvement does not depend on the direction in which the bundle of fibres is introduced into the working reach. Thus the mechanism for raising and lowering each bundle of fibres, as already described, can be retained, while still yielding the improved results just referred to. On the other hand, as mentioned above, previous machines have been very large and cumbersome and

while this has been acceptable in the past, a more compact machine is now preferred. The fact that the bundle of fibres is introduced into the working reach at a time when the pins are spaced apart means that it is possible to move the bundle of fibres into position in a lateral direction and thus obviate the need for the raising and lowering mechanism previously described, thereby materially reducing the overall height of the machine and at the same time enabling a faster rate of movement of the bundles of fibres along the machine.

If the traditional form of pin-carrying structure is retained and the arrays of pins are supported by rollers as described above, the movement for periodically adjusting the gap between the two arrays of pins in the working reach is preferably caused by pivoting one or each array about the axis of a main lower supporting roller. The effect of such pivoting movement is that the spacing is greater at the top than the bottom and when the pins are moved together in the operating cycle, combing commences at the lower end of the bundle of fibres and moves progressively upwards. This applies the load gradually until the arrays of pins reach a position in which the opposed faces in the working reach are parallel or substantially so. This leads to a more intensive hackling than with the conventional arrangement where the gap between the working reaches diverges towards the bottom to leave an appreciable gap between the opposing pins at the lower end in order to ease the strain on the fibres as the bundle is raised and the fibres are pulled through the pins which are moving in the downward direction.

Although it is possible to achieve such a result by the pivoting movement of only one array of pins, the pivoting of both arrays so as to move them by substantially equal distances leads to symmetrical working which is preferable.

In order to control the movement of the arrays of pins as they move around their closed paths, a guide roller is preferably located above each lower supporting roller so as to define the lower end of the working reach, so that when the pins are in the position of full engagement the paths of the pins below the working reach diverge. The mechanism for adjusting the spacing between the co-operating pins in the working reach is preferably cam-controlled and it may operate so that the co-operating pins separate more rapidly than they come together.

Now although the co-operating arrays of pins can operate singly, best results are obtained if there are a plurality of co-operating arrays arranged side by side such that a bundle of fibres can be moved progressively in steps in a lateral direction between the co-operating arrays so as to be combed by successive arrays of co-operating pins.

As with the traditional type of machine described above, the pinning of the co-operating arrays of pins preferably becomes progressively finer in the direction of movement of the bundle of fibres.

An example of combing mechanism in accordance with the invention in the form of a hackling machine for flax and similar fibres will now be described with reference to Figures 3 to 8 of the accompanying drawings, in which:-

Figures 3 to 6 are diagrammatic end views to an exaggerated scale illustrating successive stages in the cycle of operation;

Figure 7 is a detailed view to an enlarged scale of part of a gripping arrangement for bundles of fibres; and

Figure 8 is a sectional view on the line VIII-VIII in Figure 7.

The apparatus illustrated is designed for the hackling of flax fibres and will be described in this context, as in the original description. The scale of Figures 3 to 6 is exaggerated so as better to illustrate the effect of adjusting the gap between co-operating arrays of pins. In practice this gap will be much less than shown.

Turning first to Figure 3, a bundle of fibres 32 is shown suspended from a holder 34 which is of a modified construction as will be described. A pair of co-operating pinned sheets 31 and 33 (i.e. hackle bars supported by the tie bars spanning endless belts as described with reference to Figures 1 and 2) are illustrated in an open position in which the pins on the sheet are clear of the fibres 32. The sheet 31 passes around a main lower driving roller 37, an upper idler roller 38 and a guide roller 39 which, with the roller 38 defines the working reach. The sheet 33 passes around similar rollers 35, 40, 41, the rollers 35 and 37 turning in opposite directions so as to drive each sheet downwardly over the working reach, as illustrated by the arrows.

The rollers 38, 39 and 40, 41 are mounted on respective supporting plates 44 and 45 supported for pivotal movement about the axes of the respective driving rollers 37 and 35. Each assembly is balanced so that the effect of its own weight provides a bias which urges the two assemblies together. The two plates 44 and 45 are controlled by identical cam mechanisms each comprising a driven cam 50 co-operating with a roller follower 51 on an arm 52 pivoted at its lower end to a fixed point 53. Each arm 52 is connected at its upper end to the respective plate 44, 45 by a link 54 of adjustable length. Rotation of the cams 50 in the directions shown by the arrows and the biasing of the plates towards each other thus causes the plates 44, 45 to rock about their pivots and thus to move the sheets 31, 33 through a sequence of positions as illustrated by the successive Figures of the drawings.

As already mentioned, Figure 3 shows the sheets 31,33 in their separated or "open" position in which the flax fibres 32 may readily be moved in a horizontal direction at right angles to the plane of the paper. The fibres lie along the centre line of the gap between the two sheets, so that as the latter gradually come together, they operate symmetrically on the fibres. During the first stage of the movement as illustrated in Figure 4, the pins at the lower end of the working reach move into gradual engagement with the lower end of the bundle of fibres. Thus, in each cycle, hackling commences at the lower end of the bundle and moves progressively upwardly, thus reducing the strain on the fibres as the sheets move from the position of Figure 4 to that of Figure 5 in which the working reaches are substantially parallel and there is full engagement between the pins and fibres for the whole length of the working reach.

The cams 50 turn at a constant speed and, as seen in Figure 5, have a profile which includes a circular arc 60 which engages the respective follower 51 as the sheets 31,33 reach the parallel or closed position of Figure 5, so that there is a dwell in this position, which in a particular example may be of the order of two seconds. After this dwell, the sheets then separate again and the profile of the cams 50 is such as to cause the sheets to separate or open more rapidly than they close. This rapid opening in conjunction with the downward movement of the pins ensures that the flax bundles rapidly clear the pins and do not tend to cling to them. The position of Figure 6 which is identical to that of Figure 3, completes the cycle, and leaves the flax bundle free to be moved horizontally to the next hackling position between a corresponding pair of sheets with a finer set of pins, the cycle then being repeated as just described.

As mentioned above, the holder 34 is of a different construction from those shown in Figures 1 and 2, and is illustrated in detail in Figures 7 and 8. Basically, it comprises a pair of endless belts 65 and 66 which grip the bundles of flax between them as best seen in Figure 8. At the inlet, the belt 66 passes around a guide pulley 68 where it meets the lower belt 65, the two belts then passing together over a further pulley 70. The bundles of flax 32 are fed to the belt at the correct spacing by automatic feed apparatus (not illustrated) and, after passing the pulley 70 travel horizontally between the co-operating arrays of pins, as already described with reference to Figures 3 to 6.

To complete the gripping of the bundles 32, a roller chain 72 with side plates 73 passes around a chain wheel 74 and meets the belts 65 and 66 as they pass over the pulley 70 so that the belts are enclosed by the opposite side plates 73 as best seen in Figure 8. The lower belt 65 rests on a

support plate 76 and the bundles of flax 32 are thus held between the belts 65 and 66 in conjunction with the side plates 73, which together provide a wedging action. The belts 65 and 66 and the chain 72 move together intermittently along the length of the machine, coming to a standstill at intervals as the combing operations takes place and then moving on to transfer the respective bundles of flax 32 to the next stage of combing.

Whatever the method of holding the bundles of flax or other fibres, the ability to move each bundle from one group of pins to the next by horizontal movement, obviates the need to lift the holders, whether in the form shown in Figures 1 and 2 or Figures 7 and 8, and thus leads to the possibility of a more compact, faster machine. In addition, as previously mentioned, the pivoting of the sheets leading to the combing process extending progressively up each bundle improves the overall quality of the resultant product, but pivoting movement is not essential and a similar result may be achieved by bodily movement of each sheet in a horizontal direction so that the working reaches remain parallel throughout, or at least substantially so.

While the invention has been described in relation to a hackling machine, it will be understood that it may be applicable to other fibre combing mechanisms comprising co-operating opposed sets of toothed or pinned members, each moving in an endless path to provide a working reach between them through which bundles or slivers of fibres or the like are passed and combed.

Claims

1. Combing mechanism comprising:

co-operating arrays of pins (31,33) which are driven around closed paths to form a substantially vertical working reach over which the pins in the arrays are opposed as they move in a downward direction alongside one another in order to comb a bundle of fibres (32) located in the gap between them;

means (10,12,14) for moving a bundle of fibres into the zone of the working reach; and

mechanism (50,51,52) for periodically adjusting the spacing between the arrays of pins in the working reach; characterised in that either or each array is pivotable

and the adjustment mechanism is adapted to pivot the arrays in such a way that the pins of the opposed arrays progressively leave the bundle of fibres from top-to-bottom over the working reach when moving apart, and enter the bundle from bottom-to-top when moving together.

2. Mechanism according to claim 1, characterised

in that the arrays of pins (31,33) are supported by rollers (37,38,35,40), and the adjusting movement is caused by pivoting one or each array about the axis of a main lower supporting roller (35,37).

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3. Mechanism according to claim 1 or claim 2, characterised in that a guide roller (39,41) is located above each lower supporting roller (37,35) so as to define the lower end of the working reach so that, when the pins are in the position of full engagement, the paths of the pins below the working reach diverge.

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4. Mechanism according to any one of the preceding claims, characterised in that the mechanism (50,51,52) for adjusting the gap between the cooperating pins in the working reach is cam-controlled.

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5. Mechanism according to any one of the preceding claims, characterised in that the operation of the adjusting mechanism is such that the co-operating pins separate more rapidly than they come together.

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6. Mechanism according to any one of the preceding claims, characterized in that a plurality of co-operating arrays of pins are arranged side-by-side such that a bundle of fibres can be moved progressively in steps in a lateral direction between the co-operating arrays of pins so as to be combed by successive arrays of co-operating pins.

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7. Mechanism according to claim 6, characterised in that the pinning of the co-operating arrays of pins becomes progressively finer in the direction of movement of the bundle of fibres.

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8. Mechanism according to claim 6 or claim 7, characterised by gripping members (65,66) for holding the bundles of fibres (32) and means (70,74) for moving the gripping members in a generally horizontal direction above the co-operating arrays of pins.

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9. Mechanism according to claim 8, characterised in that the movement of the gripping members (65,66) is synchronised with the mechanism (50,51,52) for adjusting the gap between the co-operating arrays of pins so that each bundle of fibres (32) is moved from one group of pins to the next when the arrays of pins (32,33) are more spaced apart.

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10. Mechanism according to claim 8 or claim 9, characterised in that the gripping members

comprise a pair of co-operating opposed belts (65,66) guided in a generally horizontal direction so as to grip the bundles of fibres between them and move the bundles between successive groups of pins.

11. Mechanism according to any one of the preceding claims, characterised in that each array is pivotable.

12. A method of combing a bundle of fibres between co-operating opposed arrays of pins which are driven around closed paths to form a substantially vertical working reach over which the pins in the opposed arrays move in a downward direction alongside one another, in which the spacing between the opposed arrays of pins in the working reach is periodically adjusted, and the bundle of fibres is moved laterally into the zone of the working reach, characterised in that

the combing action is cyclically varied, starting at the bottom, moving progressively to the top, until the whole bundle is being combed, and then moving progressively to the bottom, so that the combing action terminates at the bottom of the bundle.

13. A method according to claim 12, characterised in that the spacing between the arrays of pins is adjusted in such a way that the pins separate more rapidly than they come together.

14. A method according to claim 12 or claim 13, characterised in that the bundle of fibres is moved progressively in steps in a lateral direction from one group of co-operating arrays of pins to the next so as to be combed by successive groups of pins of which the pinning becomes progressively finer.

15. A method according to claim 14, characterised in that the bundle of fibres is held by gripping members and is moved in a generally horizontal direction between the cooperating arrays of pins.

16. A method according to any one of claims 12 to 15, characterised in that two or more bundles of fibres are combed simultaneously between successive co-operating arrays of pins.

Revendications

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1. Mécanisme de peignage comprenant :
des rangées d'aiguilles conjuguées (31, 33) qui sont entraînées le long de circuits fermés pour former une partie travaillante sen-

siblement verticale, et dans laquelle les aiguilles des rangées sont opposées face à face en même temps qu'elles se déplacent ensemble dans une direction descendante, pour peigner un paquet de fibres (32) placé dans l'intervalle entre ces aiguilles ;

des moyens (10, 12, 14) servant à introduire un paquet de fibres dans la zone de la partie travaillante ; et

un mécanisme (50, 51, 52) servant à régler périodiquement l'espacement entre les rangées d'aiguilles dans la partie travaillante ;

caractérisé en ce que l'une ou l'autre ou chacune des rangées peut pivoter et que le mécanisme de réglage est adapté pour faire pivoter les rangées de telle manière que les aiguilles des rangées opposées abandonnent progressivement le paquet de fibres, du haut vers le bas sur la partie travaillante lorsqu'elles s'écartent, et qu'elles pénètrent progressivement dans le paquet de fibres, du bas vers le haut lorsqu'elles se rapprochent.

2. Mécanisme selon la revendication 1, caractérisé en ce que les rangées d'aiguilles (31, 33) sont supportées par des rouleaux (37, 38, 35, 40) et que le mouvement de réglage est obtenu en faisant pivoter l'une ou chacune des rangées autour de l'axe d'un rouleau support inférieur principal (35, 37).

3. Mécanisme selon la revendication 1 ou la revendication 2, caractérisé en ce qu'un rouleau de guidage (39, 41) est placé au-dessus de chaque rouleau support inférieur (37, 35) de façon à définir l'extrémité inférieure de la partie travaillante, de sorte que, lorsque les aiguilles sont dans la position de prise totale, les trajets des aiguilles au-dessous de la partie travaillante divergent.

4. Mécanisme selon une quelconque des revendications précédentes, caractérisé en ce que le mécanisme (50, 51, 52) servant à régler l'intervalle entre les aiguilles conjuguées dans la partie travaillante est commandé par came.

5. Mécanisme selon une quelconque des revendications précédentes, caractérisé en ce que le fonctionnement du mécanisme de réglage est tel que les aiguilles conjuguées s'écartent plus rapidement qu'elles ne se rapprochent.

6. Mécanisme selon une quelconque des revendications précédentes, caractérisé en ce que plusieurs rangées d'aiguilles conjuguées sont disposées côte à côte de manière qu'un paquet de fibres puisse être déplacé progressive-

ment, par pas successifs, dans une direction latérale, entre les rangées d'aiguilles conjuguées de manière à être peignées par des rangées successives d'aiguilles conjuguées.

7. Mécanisme selon la revendication 6, caractérisé en ce que la garniture des rangées d'aiguilles conjuguées devient progressivement de plus en plus fine dans le sens du déplacement du paquet de fibres.

8. Mécanisme selon la revendication 6 ou 7, caractérisé par des moyens de serrage (65, 66) servant à maintenir le paquet de fibres (32), et des moyens (70, 74) servant à déplacer les moyens de serrage dans une direction sensiblement horizontale au-dessus des rangées d'aiguilles conjuguées.

9. Mécanisme selon la revendication 8, caractérisé en ce que le déplacement des éléments de serrage (65, 66) est synchronisé avec le mécanisme (50, 51, 52) servant à régler l'intervalle entre les rangées d'aiguilles conjuguées de manière que chaque paquet de fibres (32) se déplace d'un groupe d'aiguilles au suivant lorsque les rangées d'aiguilles (32, 33) sont plus espacées.

10. Mécanisme selon la revendication 8 ou la revendication 9, caractérisé en ce que les éléments de serrage comprennent une paire de courroies opposées (65, 66) coopérant entre elles, qui sont guidées dans une direction sensiblement horizontale de manière à serrer les paquets de fibres entre elles et à faire avancer les paquets de fibres entre les groupes d'aiguilles successifs.

11. Mécanisme selon une quelconque des revendications précédentes, caractérisé en ce que chaque rangée peut pivoter.

12. Procédé de peignage d'un paquet de fibres entre des rangées opposées d'aiguilles conjuguées entre elles, qui sont entraînées le long de circuits fermés pour former une partie travaillante sensiblement verticale sur laquelle les aiguilles des rangées opposées se déplacent dans une direction descendante les unes le long des autres, en ce que l'espacement entre les rangées d'aiguilles opposées à l'intérieur de la partie travaillante est réglé périodiquement et le paquet de fibres est amené dans la zone de la partie travaillante par un déplacement latéral, caractérisé en ce que l'effet de peignage est modifié cycliquement, en commençant par le bas et en se déplaçant progressi-

vement jusqu'en haut, jusqu'à ce que la totalité du paquet soit peignée, et en se déplaçant ensuite progressivement vers le bas, de sorte que l'action de peignage se termine au bas de chaque paquet.

13. Procédé selon la revendication 12, caractérisé en ce que l'espacement entre les rangées d'aiguilles est réglé de telle manière que les aiguilles s'écartent plus rapidement qu'elles ne se rapprochent.

14. Procédé selon la revendication 12 ou la revendication 13, caractérisé en ce que le paquet de fibres est avancé progressivement, par pas successifs, dans une direction latérale, pour passer d'un groupe de rangées d'aiguilles conjuguées au suivant, de manière à être peigné par des groupes successifs d'aiguilles dont la garniture devient progressivement de plus en plus fine.

15. Procédé selon la revendication 14, caractérisé en ce que le paquet de fibres est maintenu par des éléments de serrage et est entraîné dans une direction sensiblement horizontale entre les rangées d'aiguilles conjuguées.

16. Procédé selon une quelconque des revendications 12 à 15, caractérisé en ce que deux ou plus de deux paquets de fibres sont peignés simultanément entre des rangées d'aiguilles conjuguées successives.

Patentansprüche

1. Kämmechanismus enthaltend:

zusammenwirkende Nadelreihen (31, 33), die um geschlossene Wege getrieben werden, um eine im wesentlichen senkrechte Arbeitsreichweite zu bilden, über welche die Nadeln in den Reihen gegenüberliegen, während sie sich in eine Abwärtsrichtung nebeneinander bewegen, um ein sich in der Lücke zwischen ihnen befindendes Faserbündel (32) zu kämmen; eine Vorrichtung (10, 12, 14) zum Bewegen eines Faserbündels in das Gebiet der Arbeitsreichweite; und

einen Mechanismus (50, 51, 52) zum periodischen Einstellen der Entfernung zwischen den Nadelreihen in der Arbeitsreichweite; dadurch gekennzeichnet, dass irgendeine oder jede Reihe schwenkbar ist

und der Einstellungsmechanismus angeordnet ist, die Reihen derart zu schwenken, dass die Nadeln der gegenüberliegenden Reihen die Faserbündel progressiv von oben nach unten über die Arbeitsreichweite verlassen, wenn sie

sich auseinanderbewegen, und in das Bündel von unten nach oben eintreten, wenn sie sich zusammenbewegen.

2. Mechanismus nach Anspruch 1, dadurch gekennzeichnet, dass die Nadelreihen (31, 33) von Rollen (37, 38, 35, 40) getragen werden, und die Einstellungsbewegung durch Schwenken einer oder jeder Reihe um die Achse einer hauptsächlich tieferen Tragrolle (35, 37) verursacht wird.

3. Mechanismus nach Anspruch 1 oder Anspruch 2, dadurch gekennzeichnet, dass eine Führungsrolle (39,41) über jeder unteren Tragrolle (37,35) angeordnet ist, um das untere Ende des Arbeitsbereichs zu definieren, so dass, wenn die Nadeln in der Stellung vollen Eingriffs sind, die Wege der Nadeln unter der Arbeitsreichweite auseinandergehen.

4. Mechanismus nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, dass der Mechanismus (50,51,52) zum Einstellen der Lücke zwischen den zusammenwirkenden Nadeln in der Arbeitsreichweitenockengesteuert ist.

5. Mechanismus nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, dass der Betrieb des Einstellungsmechanismus so ist, dass die zusammenwirkenden Nadeln sich schneller trennen als dass sie zusammenkommen.

6. Mechanismus nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, dass eine Vielzahl von zusammenwirkenden Nadelreihen nebeneinander angeordnet sind, so dass ein Faserbündel progressiv stufenweise in einer lateralen Richtung zwischen den zusammenwirkenden Nadelreihen bewegt werden kann, um so von aufeinanderfolgenden Reihen von zusammenwirkenden Nadeln gekämmt zu werden.

7. Mechanismus nach Anspruch 6, dadurch gekennzeichnet, dass das Nadeln der zusammenwirkenden Nadelreihen progressiv feiner in die Bewegungsrichtung des Faserbündels wird.

8. Mechanismus nach Anspruch 6 oder Anspruch 7, gekennzeichnet durch Klemmglieder (65,66) zum Halten der Faserbündel (32) und einer Vorrichtung (70,74) zum Bewegen der Klemmglieder in eine im allgemeinen horizontalen Richtung über die zusammenwirkenden Nadel-

reihen.

9. Mechanismus nach Anspruch 8, dadurch gekennzeichnet, dass die Bewegung der Klemmglieder (65,66) mit dem Mechanismus (50,51,52) zum Einstellen der Lücke zwischen den zusammenwirkenden Nadelreihen synchronisiert ist, so dass jedes Faserbündel (32) von einer Nadelgruppe zur nächsten bewegt wird, wenn die Nadelreihen (32,33) mehr voneinander entfernt sind. 5
10. Mechanismus nach Anspruch 8 oder Anspruch 9, dadurch gekennzeichnet, dass die Klemmglieder ein Paar von zusammenwirkenden gegenüberliegenden Riemen (65,66) umfassen, die in einer im allgemeinen horizontalen Richtung geführt werden, um so die Faserbündel zwischen sich einzuklemmen und die Bündel zwischen nachfolgenden Nadelgruppen zu bewegen. 10 15 20
11. Mechanismus nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, dass jede Reihe schwenkbar ist. 25
12. Verfahren zum Kämmen eines Faserbündels zwischen zusammenwirkenden gegenüberliegenden Nadelreihen, die um geschlossene Wege getrieben werden, um eine im wesentlichen senkrechte Arbeitsreichweite zu bilden, über welche sich die Nadeln in den gegenüberliegenden Reihen nebeneinander in eine Abwärtsrichtung bewegen, in welcher die Entfernung zwischen den gegenüberliegenden Nadelreihen in der Arbeitsreichweite periodisch eingestellt wird, und das Faserbündel seitlich in die Zone der Arbeitsreichweite bewegt wird, dadurch gekennzeichnet, dass der Kämmvorgang zyklisch variiert wird, von unten anfangen, sich progressiv nach oben bewegend, bis das ganze Bündel gekämmt ist, und sich dann progressiv nach unten bewegend, so der Kämmvorgang an dem Boden des Bündels endet. 30 35 40 45
13. Verfahren nach Anspruch 12, dadurch gekennzeichnet, dass die Entfernung zwischen den Nadelreihen so eingestellt wird, dass die Nadeln sich schneller trennen als dass sie zusammenkommen. 50
14. Verfahren nach Anspruch 12 oder Anspruch 13, dadurch gekennzeichnet, dass das Faserbündel progressiv schrittweise in eine seitliche Richtung von einer Gruppe von zusammenwirkenden Nadelreihen zur nächsten bewegt wird, um so von nachfolgenden Nadelgruppen ge- 55

kämmt zu werden, von welchen das Nadeln progressiv feiner wird.

15. Verfahren nach Anspruch 14, dadurch gekennzeichnet, dass das Faserbündel von Klemmgliedern gehalten wird und in eine im allgemeinen horizontale Richtung zwischen den zusammenwirkenden Nadelreihen bewegt wird.
16. Verfahren nach einem der Ansprüche 12 bis 15, dadurch gekennzeichnet, dass zwei oder mehr Faserbündel gleichzeitig zwischen aufeinanderfolgenden zusammenwirkenden Nadelreihen gekämmt werden.

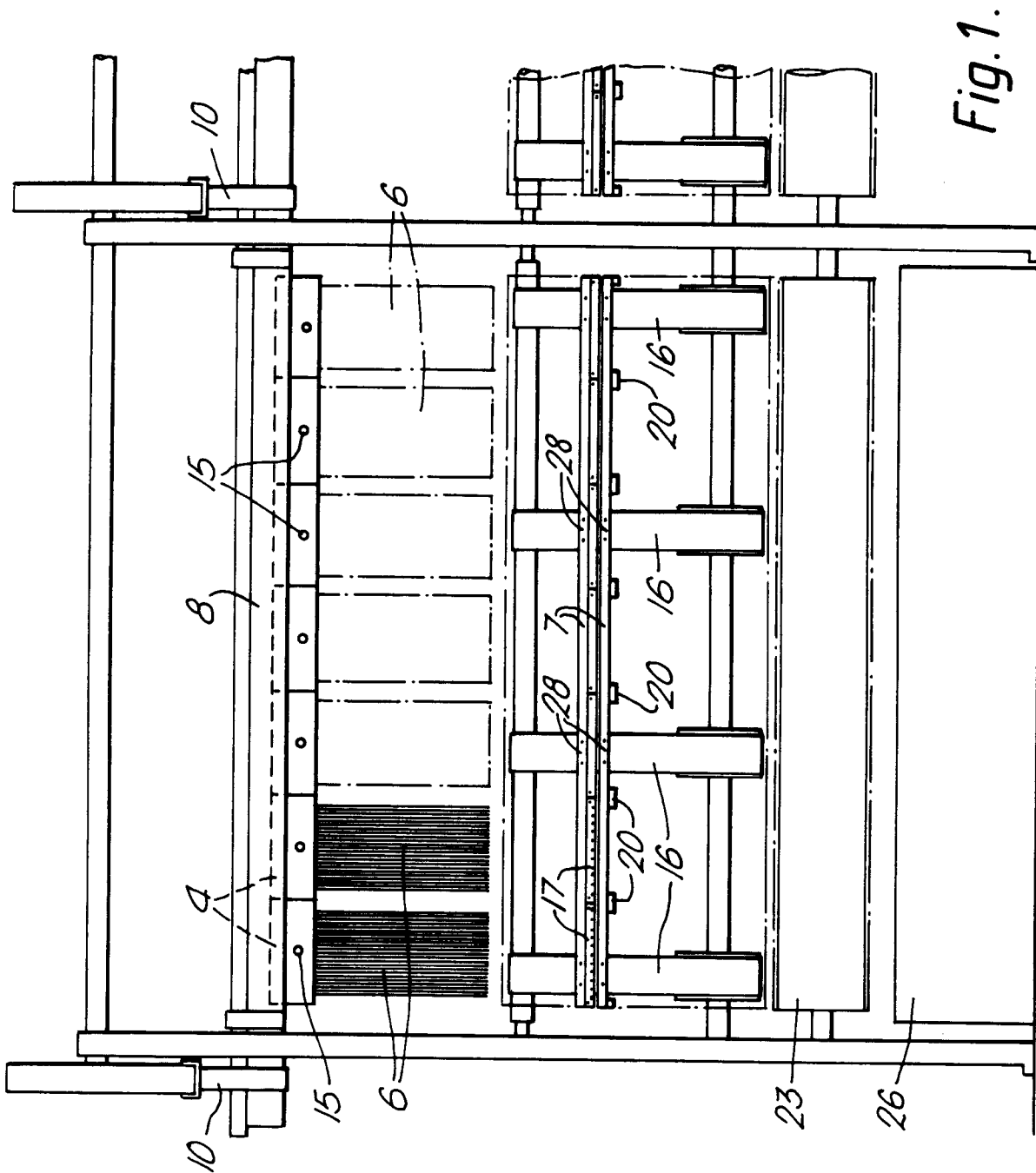
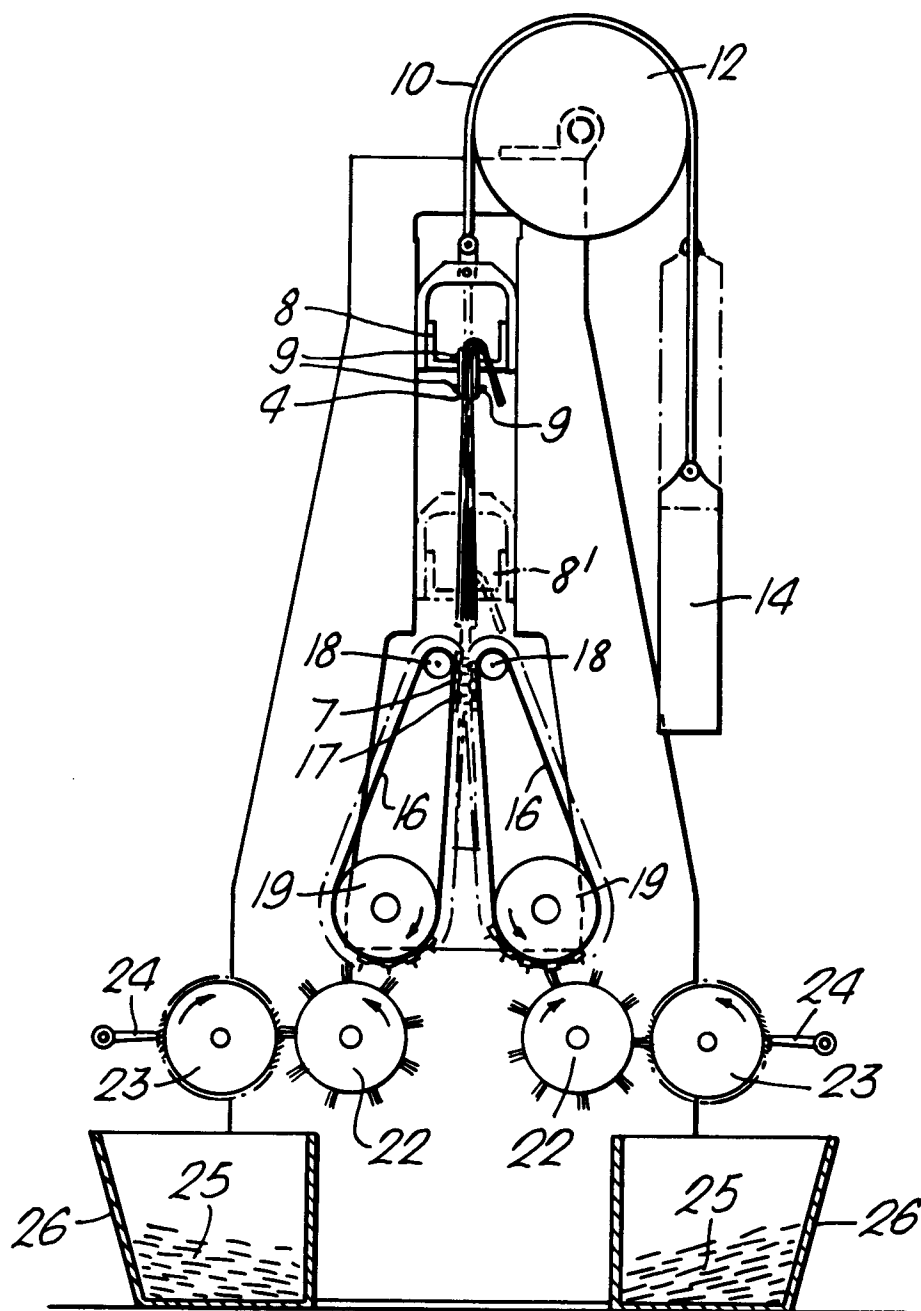


Fig.2.



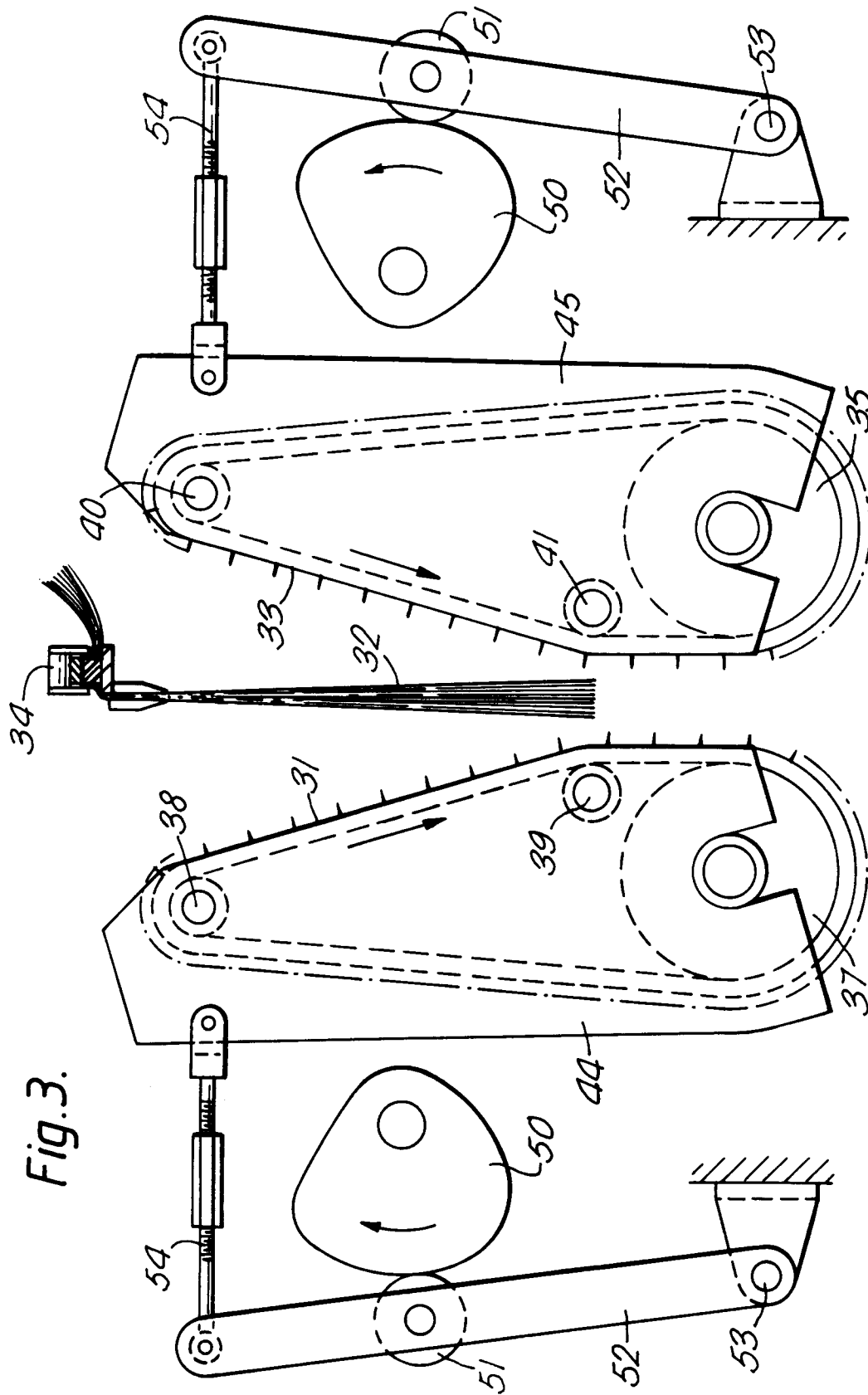
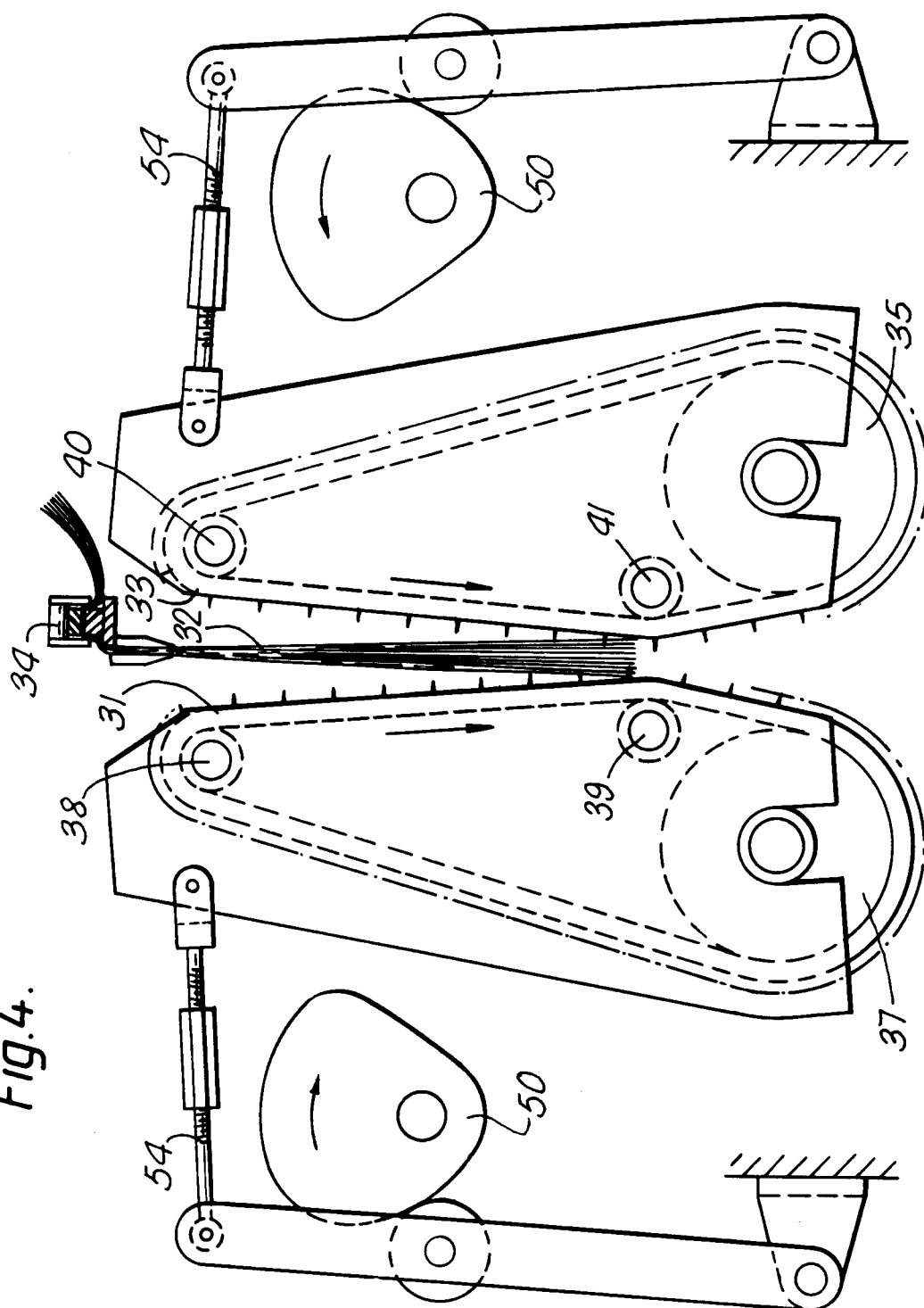
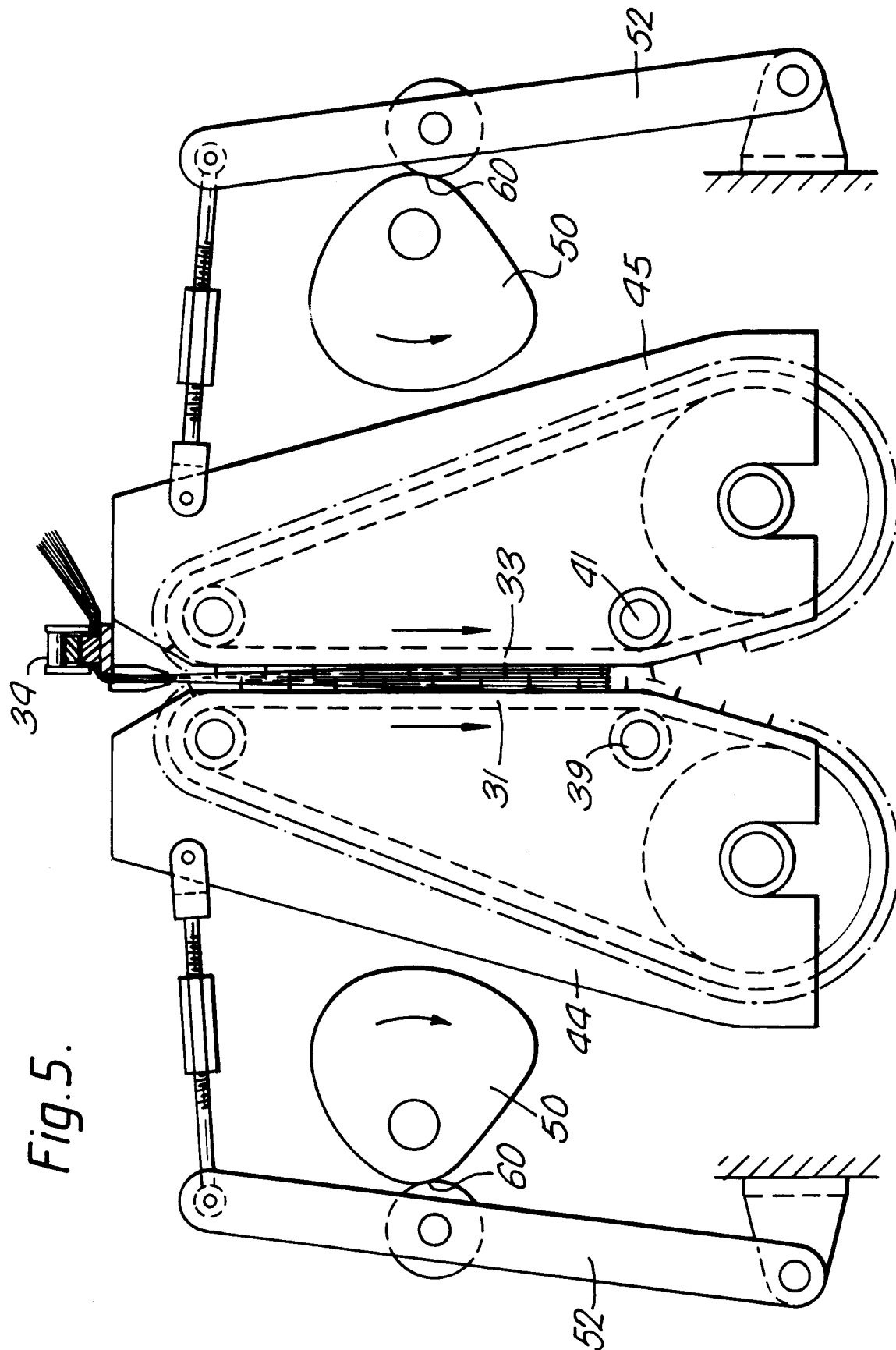


Fig.4.





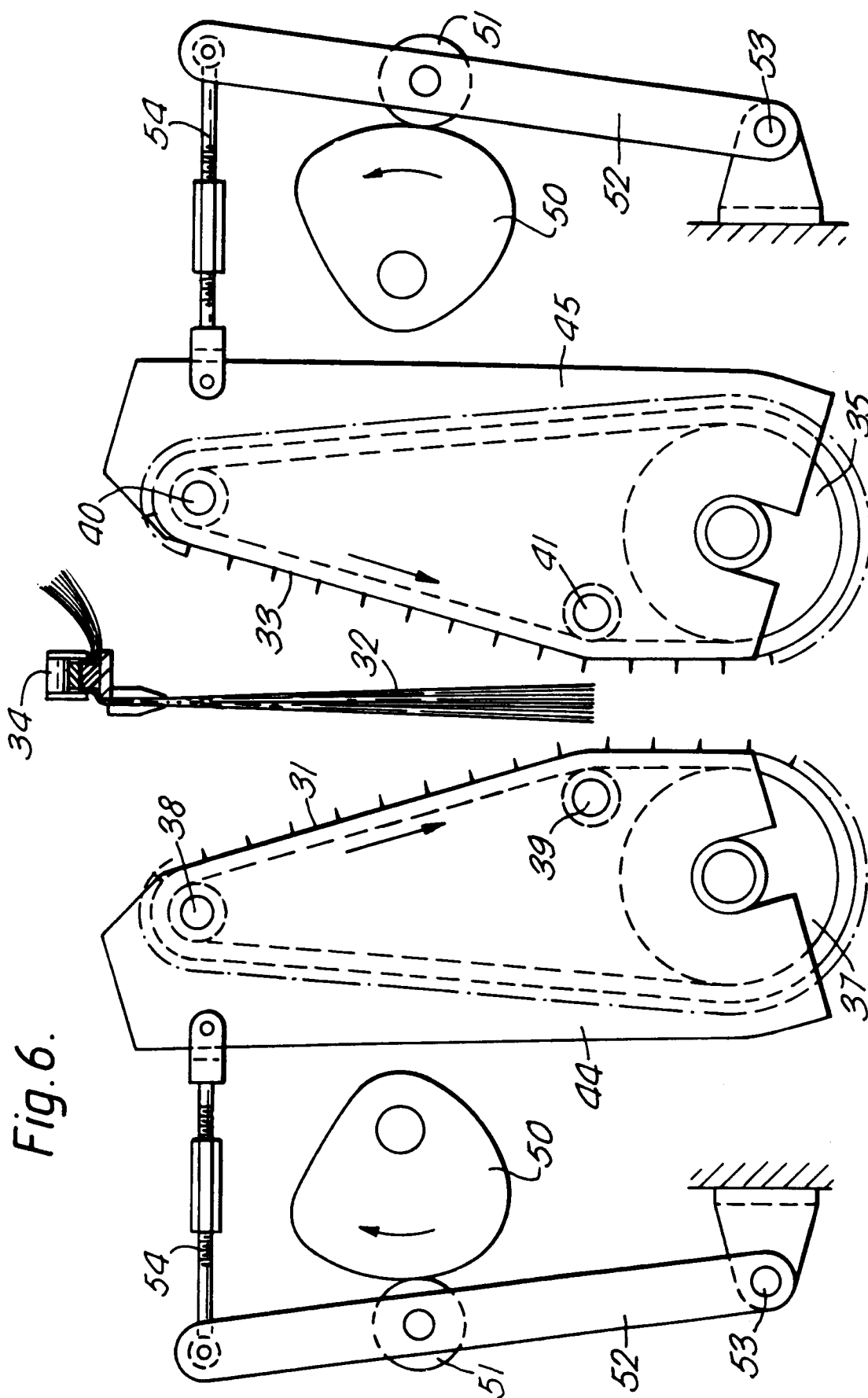


Fig.7.

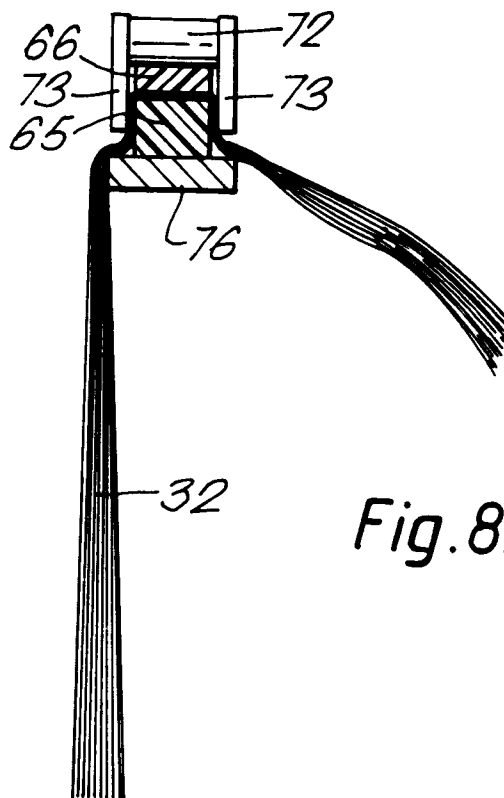
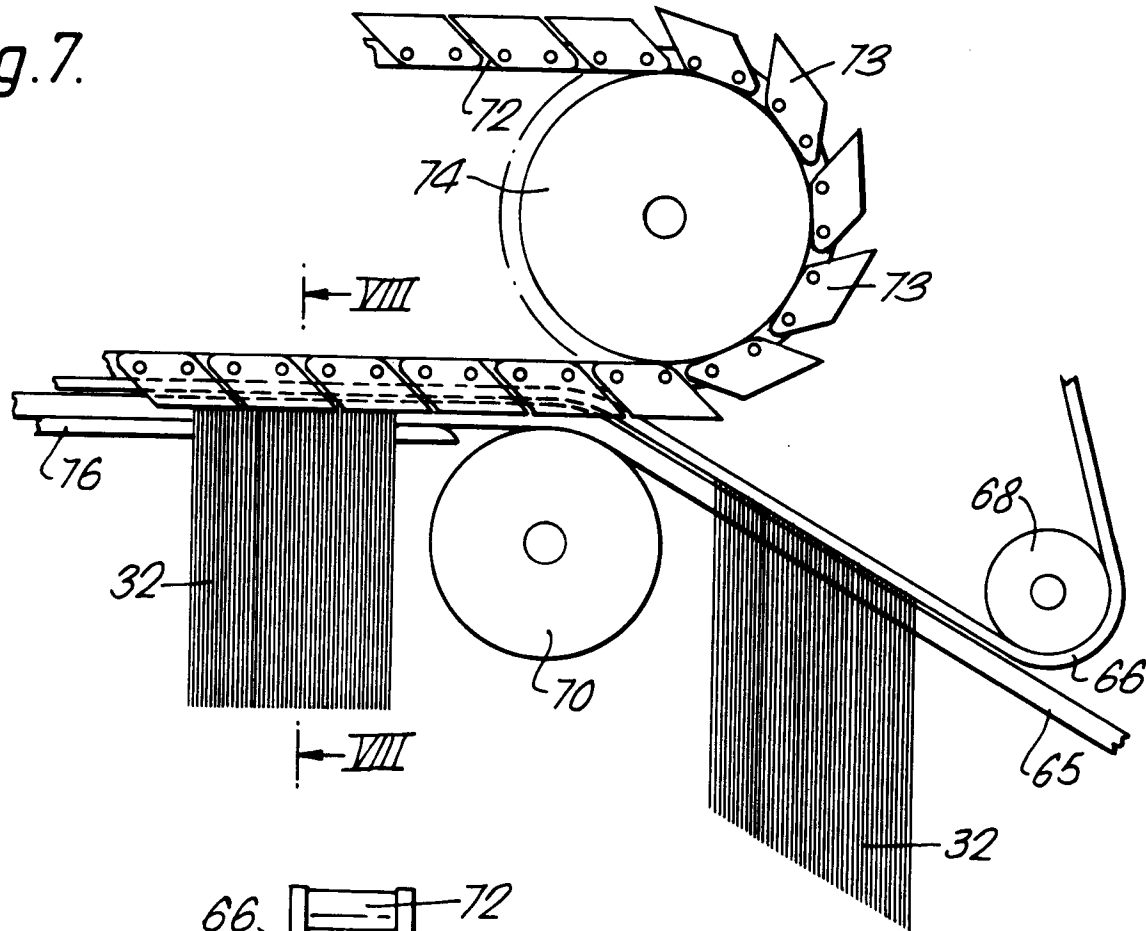


Fig.8.