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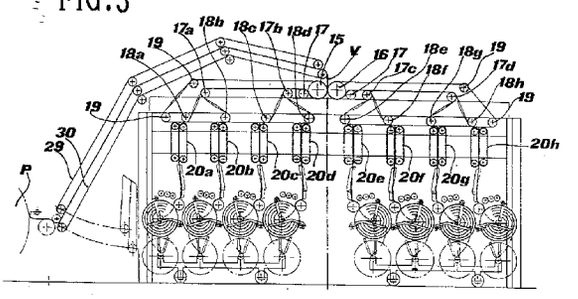
## (54) Horizontal condenser for card set, with automatic spool changing.

(57) Condenser (D) of card web (V) for card set (C,P), comprising a pair of horizontally adjacent take-in rollers (15,16) ; a plurality of tapes guided around said rollers in alternating diverging directions to divide the card web into ribbons in a plurality of horizontally distributed banks ; means for feeding the ribbons vertically to a plurality of rubbing leathers (42) and to a plurality of collecting spools (CA) ; and spool change-over means and spool transporting means (51,52). Said change-over means (50) comprise, for each collecting (CA) spool, a transfer roller (43), means (44) for feeding and distributing the roving (41) to said transfer cylinder, a support in the form of a pair of oscillating arms (47) for supporting a spool in the course of winding in contact with said cylinder, between a loading position and a discharging position. Said transporting means comprise at least one carriage (52) mounted so as to move on horizontal guides positioned beneath the condenser (D) and equipped with a plurality of supporting saddles (51), each for one spool.

FIG.3

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As is known, the web condenser - or "condenser" for short as it is called in carding - is a complementary apparatus to the card set, and its function is to divide the web coming from the finisher card, as it leaves the doffer, into a plurality of ribbons having the same width and count. These ribbons then undergo an operation of rubbing in which the textile fibres are gathered and compacted into a cylindrical shape to form rovings strong enough for the next processing stage. The rovings are in fact normally collected onto spools which are then used to feed the spinning machines.

To perform its task, the condenser comprises:

- a pair of vertically arranged take-in rollers which rotate in contact with each other and in opposite directions,
- a plurality of relatively narrow tapes, for example 8-30 mm in width, guided around these take-in rollers and following an endless path to the rubbing leathers, and
- a plurality of rubbing leathers arranged in parallel in a number of vertically arranged banks.

The arrangement is such that, along the line of contact between the two take-in rollers, each tape is guided around one of the rollers in the space between two successive tapes running around the other roller; the tapes that travel around the top roller and enter in a downward direction emerge on the bottom roller, also in a downward direction, and vice versa. In this way when the web coming off the doffer is fed between the take-in rollers, or rather between the opposing tapes, it is cut by these tapes into ribbons which follow the tapes along their path from the rollers to the rubbing leathers. This arrangement is perfectly familiar to those skilled in the art, so further details are not felt to be necessary.

What is worth observing is that there are at present many kinds of condensers having different technical characteristics to meet the highly diverse range of needs of users, especially as far as the textile fibres and the counts processed are concerned. In particular:

- the web may be divided into widths varying from 8 to 30 mm,
- a single tape following a back-and-forth path may be used, or one tape for every two rovings, or one tape for every roving,
- 2, 4 or 6 banks may be provided,
- the rubbing leathers may be arranged to perform a single, double or triple rubbing operation,
- the collecting spool system may have from 4 to 24 spools and may be of the fixed type with moving roving guides or of the moving type with fixed roving guides, or indeed of the double type with moving roving guides.

Despite the differences cited, many known condensers do however have in common the first-described arrangement, with vertically arranged take-in rollers and rubbing leathers forming several horizontal or approximately horizontal banks 1 above the other, as schematically shown in Fig. 1 in BE-A-564,197, which depicts a configuration having 1 roving/1 tape. This arrangement, which for the sake of simplicity of description will be referred to in this text as a "vertical condenser", does however have limits, if not disadvantages, and in particular:

- the number of vertically arranged banks of rubbing leathers cannot be increased, for this would render the higher banks practically inaccessible, and consequently
- nor does it allow the rubbing stroke of the leathers to be increased, which means that double or triple rubbing has to be employed, as further explained below.

French Patent no. 1,143,965 describes, however, an arrangement which may be defined as a "horizontal condenser" in which the card web is guided in a downward direction between a pair of horizontally adjacent take-in rollers and then the ribbons are fed to a plurality of rubbing leathers which are also horizontally adjacent. Here the web arriving from the finisher card (which is located above the horizontal condenser) is then fed directly to a spinning machine located beneath it.

This horizontal condenser - which ought in theory to solve at least some of the problems outlined above, but which in practice has never been used, even experimentally, on a card - actually creates other problems. In the first place, the system stands some 6 m high, making it both rather large and difficult to control for the operator. Another problem is the inevitable difficulties of synchronizing the condenser and the spinning machine, given that the two machines have two different operating cycles. What is more, the interaction between the carding and spinning frames overcomplicates the problems of cleaning and maintaining the individual components.

There are similar problems in the condenser illustrated in Belgian Patent no. 506,344, which also has a horizontal configuration. This condenser has a corridor beneath the rubbing output to allow for spool collection or for siting a spinning frame integrated with the rest of the system. Apart from the faults described in reference to the condenser according to French Patent no. 1,143,965, in this device the web rests loosely on the cloth carrying it from the card outlet to the condenser, with the risk of the formation of irreversible longitudinal folds, which would compromise the count.

Systems partly analogous to those described above are described in French Patents nos. 1,076,166 and 2,240,306.

In spite of the existence of these patents and the teaching they provide for "horizontal condensers", the only arrangement which, though with differences, is being used in carding engines in present-day production and is actually proposed in the specialist literature covering this sector of the art, is the "vertical condenser" arrnagement. The literature does not indicate whether the reason why the various proposals for "horizontal condensers" have never been brought to industrial application is to be found in the disadvantages cited above, or elsewhere: quite simply, there is no discussion of the question, even at an experimental level. However, it is the opinion of the Applicant that in addition to the various problems of a practical nature that have been mentioned, one has been decisive, namely the impossibility of achieving correct handling of the rovings emerging from the rubbing leathers.

The fact is that, in the first place, all those systems (see FR-A-1,076,166, FR-A-1,143,965 or FR-A-2,240,306) in which a spinning machine is placed immediately downstream of the condenser and the roving is guided directly from the condenser to the spinning machine, are incapable of operating, owing in part to the practical problems already discussed and also because the operating cycles of these two machines are fundamentally different and in essence incompatible.

In the second place, none of the documents cited provides any means at all for practical and efficient spool-changing (even BE-A-507,344 fails to do so, though its Figure 1 shows a spool collecting system); and yet efficient spool changing is regarded - in current practice, using vertical condensers, where access to and removal of spools occurs from the front, by hand or with a lifting carriage - as an essential condition for avoiding unacceptable stoppages of the carding frame.

It is an object of the present invention to provide a "horizontal condenser" structure which will overcome the drawbacks of the prior art as discussed above and in which it will be possible both correctly to transfer the rovings to and collect them on spools, and also, and more especially, to load and unload the spools automatically, in order that spinning can then be carried out on separate suitable machines.

This object is achieved, in a condenser basically of the kind according to BE-A-507,344 and as stated in the introductory portion of Claim 1, by virtue of the features described in the characterizing portion of the same Claim 1. Preferred embodiments are described in the dependent claims.

Further features and advantages of the condenser according to the invention will however be made clear in the following detailed description of a number of preferred embodiments thereof. These are provided by way of example and illustrated in the accompanying drawings in which:

Fig. 1 is an overall schematic of the final part of a card set ending with a vertical condenser of the prior art;

Figs. 2a and 2b are side and plan views respectively of a condenser device of the prior art, for example according to BE-A-564,197;

Figs. 3 and 4 are two general views, the former from the side and the latter from above, of a condenser according to the present invention, with its associated means for collecting the rovings;

Fig. 5 is a side view in greater detail, and on an enlarged scale, of one of the devices for collecting rovings onto spools and for automatically changing the latter;

Fig. 6 is a partial front view of the same device as in Figure 5;

Figs. 7 and 8 are views similar to Figure 5 showing two different embodiments.

To enable the invention and its attendant advantages to be understood more clearly, it may be helpful to begin with a brief description of the prior art, with reference to Figures 1 and 2.

Figure 1 is a diagrammatic rendering of the final part of a card set, in which the finisher card C of the set, the doffer P and the condenser D can be seen.

Figures 2a and 2b illustrate a known kind of condenser (for example according to BE-A-564,197), in which arrangement a pair of take-in rollers 1 and 2 are vertically arranged in contact with each other. Guided around these rollers are the tapes 3: the arrangement illustrated is of one tape for every two rovings (but the same considerations apply for an arrangement with a single tape for all the rovings), where each tape is guided around an endless path passing from the take-in roller 2 around the smaller rollers 4, 5a or 5b and 6 (towards the lower rubbing leathers 7a and 7b), then around the roller 8 and back to the roller 2; from here around the take-in roller 1, then onto the smaller rollers 9, 10a or 10b and 11 (towards the upper rubbing leathers 7c and 7d), and from here around the roller 12 and back again to the roller 1, where it resumes its journey around the take-in roller 2.

When the card web V is introduced between the rollers 1 and 2, it is cut into as many ribbons as there are lengths of tape passing around said rollers; these ribbons are then guided separately, supported by each respective tape, towards the rubbing leathers 7. In the arrangement shown in Figure 2a there are four paths for the ribbons, namely:

- from take-in roller 2, around rollers 4 and 5a, towards leather 7a,
- from take-in roller 2, around rollers 4 and 5b, towards leather 7b,
- from take-in roller 1, around rollers 9 and 10a,

towards leather 7c,
- from take-in roller 1, around rollers 9 and 10b, towards leather 7d.

The rubbing leathers - which, as is known, are given a forward and parallel movement for roving transport and opposing sideways movements for rubbing convert the ribbons into rovings which are then wound onto the bobbins or spools 13. In the arrangement shown in Figure 2a there are two pairs of rubbing leathers for each series of rovings and they are distributed in four "banks", i.e. four roving transporting planes, specifically rubbing planes 7a, 7b, 7c and 7d respectively; for each transporting plane there are four series of spools 13a, 13b, 13c and 13d to collect the rovings, as is more clearly visible in Figure 2b. This figures also shows that, compared with the width in plan view of the rollers 1, 2, denoted $1_1$, the total width $1_2$ occupied in plan view by the spools 13 is noticeably greater: this is in order to allow for the lateral separation, fan-wise, of the rovings as they leave the rubbing leathers and for their winding onto the spools separately from each other, that is avoiding superimpositions. The more the fan is widened out the greater the width that can be obtained, and hence the capacity of the windings or cheeses of rovings wound onto the spools.

All these known arrangements have at least the following disadvantages:

a) - in the case of wider cards - that is, where dimension $l_1$ is greater and hence also length $l_2$ proportionally - the fan of rovings must be significantly opened out, which means they become stretched and eventually the count of the rovings becomes insufficiently even;

b) - the sideways stroke of the rubbing leathers is still relatively limited and as a result the rubbing action is often insufficient for, in view of the fact that the space between one ribbon and the next in the same transporting plane is equal to three times (where there are four transporting planes) the width of each tape, said sideways stroke must be less than this space if entanglements between the fibres of adjacent ribbons are to be avoided (currently this width is of the order of 19 to 30 mm).

In order to overcome at least the first of these disadvantages, the prior art has already proposed an arrangement in which there are two banks of spools for each rubbing plane. However, this arrangement also has other kinds of disadvantages owing to the fact that great difficulties are encountered in the operations of removing and changing the innermost series of spools, as well as in re-tying broken rovings at such points, and indeed the fact that there are long stretches of roving that are uncontrolled.

Moreover, even in another known arrangement, in which the increase in the number of spools is achieved by providing six transporting planes of rubbing leathers and therefore six planes of spools in a single vertical alignment, great difficulties are encountered in the operations of removing and changing the spools, as well as in the operations of re-tying broken rovings, because of the great height (approx. 3 m) at which the two highest banks of spools are situated.

These disadvantages and difficulties of the prior art can now be solved by the condenser device according to the present invention which radically alters the vertical condenser design used hitherto by arranging the take-in rollers adjacently in a horizontal plane and the aligned banks also horizontally, while the card web is fed vertically both to the take-in rollers and to the rubbing leathers, which latter are arranged such that their rubbing planes are vertical.

This construction, already illustrated in general terms in BE-A-507,344, will now be described in detail with reference to the preferred embodiment of the present invention as illustrated in Figures 3 to 5.

The two take-in rollers 15 and 16 are horizontally adjacent and there are eight banks approached individually through the two series of rollers 17 and 18, which are adjacent in horizontal succession (rather than vertically one above the other, the form adopted in all prior art condensers). These eight banks feed the ribbons to the rubbing leathers 20 whose working surfaces are oriented in vertical planes.

An immediate consequence of this construction according to the invention is that there are no longer any limits, whether structural or operational, as to the number of banks that may be desired and which may be increased much beyond the number eight depicted in the drawings. This is because however large the number of banks:
- there is no change to the problems of access to the rubbing leathers for re-tying broken rovings,
- nor is there any change to the problems of removing and changing the means of collecting the rovings, as will be clearly demonstrated later.

In the embodiment shown in Figure 3 the arrangement is of the kind using one tape for every two rovings, or alternatively a single tape for all the rovings. As the drawing shows, each tape is guided in a closed loop which begins for example at roller 16 and, travelling inwards, passes around the roller 15 and then (travelling to the left in the drawing) passes around the smaller rollers 17 and 17a or 17b, then around the rollers 18a or 18b, or else 18c or 18d, and then around the rollers 19 and back to the outer side of the roller 15; from here the tape, passing under the roller 16 in an inward direction, runs (travelling to the right in the drawing) over the rollers 17 and 17c or

17d, then over the rollers 18e or 18f, or else 18g or 18h, then around the rollers 19 and back again to the outer side of the roller 16 to resume its path underneath the roller 15.

When the card web V is introduced vertically in a downward direction between the rollers 15 and 16, it is cut into as many ribbons as there lengths of tape passing around these rollers; these ribbons are then guided separately towards the rubbing leathers 20, supported by each respective tape in the usual way along paths that are easily identifiable in the drawing, namely:

- from take-in roller 15, around rollers 17a and 18a, towards leather 20a,
- from take-in roller 15, around rollers 17a and 18b, towards leather 20b,
- from take-in roller 15, around rollers 17b and 18c, towards leather 20c,
- from take-in roller 15, around rollers 17b and 18d, towards leather 20d,

in order to feed the ribbon towards the four rubbing leathers on the left-hand side of the drawing, whereas in order to feed the ribbon towards the four rubbing leathers on the right-hand side of the drawing the ribbon follows mirror-image paths over the rollers 17c, 17d and 18e, 18h.

As an alternative, it would be possible to have one tape for every roving; this alternative would have the advantage of eliminating the problem, noted earlier, of the different support of the ribbons of web between one half and the other of the condenser, for in this case the ribbons divided by the take-in rollers 15 and 16 - ribbons which are held between the surfaces of the rollers and the tapes around them - will subsequently be supported on the surface of these tapes which, as they run towards the rollers 18, are always underneath said ribbons. Such an alternative embodiment is however within the scope of one skilled in the art so it is not felt necessary to illustrate it, especially as it does not strictly form part of the present invention.

Returning to Figure 3, however, it should be observed that the card web has to be guided positively between the point of its emergence from the doffer P of the card and the point of its entry between the rollers 15 and 16. Accordingly if the card set is arranged substantially on the same level as the condenser (as is normally the case and as is depicted), then according to the present invention a pair of adjacent conveyor belts or cloths 29 and 30 will be provided, with the card web being held and guided between them. These cloths are made of a special material, for example Transilon, and are very thin, have smooth surfaces without the least asperity and are treated to make them antistatic; these are mounted on and travel around perfectly cylindrical rollers and maintain the integrity of the web, keeping it free of folds or creases, exactly as it emerges from the doffer.

It is also important to note that the horizontal condenser system according to the invention overcomes all the problems of the prior art in relation to the forming of the fan as seen above with reference to Figure 2b. As can be seen in Figure 4, the horizontal condenser enables the web to be subdivided over a number of banks distributed lengthwise along the delivery axis of the card, which means that no fan need be formed at all. Figure 4 shows that the transverse width requirement $l_2$ of the spools arranged two by two is no more than the width $l_1$ of the card web.

As the rovings leave the rubbing leathers 20 they therefore pass onto the spool-type collecting system, which will be described in greater detail below with reference to the embodiment depicted in Figures 5 and 6. This system, according to a fundamental characteristic of the invention, permits easy and practical spool changing by automatic means.

In this embodiment the roving 41 emerging from a pair of rubbing leathers 42 descends under gravity in a downward direction to a transfer roller 43, passing via a roving guide 44. The roller 43 is parallel to and in contact with a spool CA which consists of the winding of the rovings 41 onto a spindle 45 that acts as a rigid supporting base. The function of the roller 43 is therefore on the one hand to transfer the roving onto the spool, and on the other hand to drive the spool round by simple peripheral contact.

The roving 41 is controlled in its descent by the roving guide 44 which oscillates in an essentially vertical plane (arrow Fg in Figure 6), which corresponds to the plane of alignment of a series of rovings descending from the rubbing leathers. By means of this oscillating movement of the aligned rovings, the latter form corresponding adjacent windings or cheeses CA1, CA2, CA3, etc. on the spindle 45. The winding takes place with no tension in the rovings since the roller 43 rotates at a speed related to the speed of descent of the rovings.

The width of each cheese is equal to the product of the number of banks multiplied by the width of the tape. In the case of horizontal arrangement of the condenser according to the invention it is possible, as already stated, to use a sufficiently large number of banks that the rovings can be fed in a straight line towards the spools so that no fan need be created.

Adjacent to and underneath the roller 43 is an oscillating spool supporting system: this is formed by a first pair of arms 46 attached pivotably to a common shaft 46a parallel to the axis of the roller 43. At each free end of these arms 46 is a groove in which the two opposite pin-shaped ends 45a of a spindle 45 rest. When winding begins, the arms 46 are raised to their full extent (the position indicated by the dot-dash line

46') and the spindle 45 is resting directly on the roller 43 (position 45'''). As winding proceeds, the spool CA grows in diameter and the arms 46 swing downwards anticlockwise to keep the spool periphery in constant contact with the transfer roller 43 with a controlled pressure (the control of this pressure will be considered later), eventually coming to the position 45 shown in solid lines.

Underneath the pair of arms 46 by which the spool is supported during winding, there is also a second pair of arms 47 which guide the spool during its discharging. These arms are attached pivotably to a common shaft 47a also parallel to and underneath the axis of the roller 43. The function of these arms 47 is to support the pin ends 45a of the spools from the moment they are released by the arms 46 (the end-of-winding position indicated in solid lines in Figure 5) until the moment they are discharged onto the carriage (position 47' indicated in dot-dash lines) as detailed below.

The change-over unit also comprises a feeder 49 for holding and inserting spindles 45 which is composed of a trough 49a and two opposing guides, each formed by a first oblique or almost horizontal guide part 49b and a second curved guide part 49d whose centre of curvature is on the axis of the roller 43, with an interposed resting and releasing device 49c. The trough 49a can tilt about one of its axes 49'a, which is parallel to the axis of the roller 43, in order to insert and position a spindle inside the guide 49b. Along said guides the spindles are engaged by the ends 45a of their shafts and are guided freely downwards purely by means of gravity, initially to a position where they stop and wait 45', and later to the starting positions 45" and 45''', as explained below.

The automatic change-over unit is completed by the following parts:

a) a system of two retaining bars 50, to control the descent of the full spool CA towards a support 51 forming part of a carriage 52. These bars 50 are mounted vertically at the two opposite ends of the spool, between these ends and the arms 47. The bars 50 and the arms 47 intersect each other over almost the whole clockwise stroke F from the position 47 in which the spool is taken over to the position 47' in which it is discharged. The lower ends 50' of the bars 50 also continue downwards and terminate close to the support 51;

b) a system of two transverse rods 53 moved in opposing directions and each carrying a plate 53a which clamps the rovings. These plates 53a are approximately horizontal and cut through the vertical plane 41' down which the rovings freely fall when not wound onto the spool CA. The plates 53a, which in the rest position lie on either side of the alignment of the rovings on the plane 41', move towards each other, with the rods 53, to clamp the rovings between themselves, as described in more detail below;

c) a system for recommencing the winding, which comprises a crossmember 54 carried by a pair of arcuate arms 55 rotating as one about an axis 55a. The two arms 55 are, like the arms 46 and 47,outside the space occupied by the spool CA. When at rest, the crossmember 54 is in the position indicated in solid lines underneath the roller 43, while in the working position said crossmember moves - by rotating anticlockwise around the pin 55a along the arc indicated by arrow F' - above the spindle 45''' in the starting position; and

d) a system for controlling the contact pressure of the spool CA on the periphery of the drive roller 43. This system comprises a counterweight 56, which acts on the arm 46 through a cord 57 passing over rollers 58 and attached at 57a directly to the arm 46. Preferably, as is shown in Figure 5, the counterweight 56 is in the form of a hood and also serves to protect the spool during winding. Alternatively some other kind of means could be employed, such as a calibrated spring.

The operation of the device described above comprises the following steps:

a) - initially a spindle is located in position 45', held by the release device 49c. A few moments before change-over begins, the device 49c rotates in an anticlockwise direction, taking the spindle to position 45" in contact with the roller 43, where it remains for the entire spool-discharging period, controlling the flow of the rovings. As soon as the arms 46 return to the starting position 46', after the discharge, the device 49c rotates further to allow the spindle to drop into position 45''' where its end pins 45a fit into the grooves of the arms 46. The counterweight 56 acts on the arms 46 in such as way as to keep the spindle in contact with the circumference of the roller 43 with controlled pressure;

b) - as the roller 43 rotates, the spindle 45 also rotates, winding the rovings and forming the spool CA. As winding proceeds, the spool support arm 46 is made to swing downwards. In its descent the spool is guided by the fact that its pins 45a are resting on the arms 46. It is important to note that throughout this step of winding the counterweight 56 continues to exert on the arms 46 a tension which gradually comes to be balanced by the increasing weight of the spool: by this means, therefore, an automatic control is provided over the contact pressure between the spool and the roller 43, which must be at its maximum at the

start (position 46') in order that the rovings are wound tightly, and must then be reduced as the diameter of the winding grows;

c) - when spool CA winding is complete (the position indicated in solid lines in Figure 5), or indeed at any moment when it is desired to discharge the spool, a control device (not shown) acts on the shaft 46a of the arms 46 so as to turn them anticlockwise to the point where the end pins 45a touch the retaining bars 50 and consequently disengage themselves from the arms 46 and are deposited onto the arms 47. At this point the arms 47 are caused to rotate downward in a controlled manner (direction F) into the position 47' indicated in dot-dash lines, where their ends are a short distance from the ends 50' of the bars 50 to allow the pins 45a to pass out. The spool is therefore free to drop down into position CA' in which the pins 45a are resting on the support 51. In this position the support 51 is located underneath the respective transfer roller 43 but not in lateral alignment therewith, which means that the rovings continue to drop down in a vertical plane 41'. When all the supports 51 of one carriage 52 have been filled with spools, the carriage is run along on a rail to take away the full spools and to be replaced with an empty carriage. It will obviously be within the capacity of anyone skilled in the art to substitute any other transporting device for the carriage 52 - e.g. a chain conveyor which would take the spools on supports and carry them away from the condenser so that they could be then passed to the spinning machines;

d) - the arms 46 swing up again to their initial position as soon as the spools CA are released and are still descending towards position CA'. When the arms 46 are in position 46', an empty spindle 45 is lowered onto the release device 49, as described above, and a new cycle begun;

e) - during steps a) to d), the rovings are allowed to continue to fall freely. At the end of step d) the two rods 53 are made to move towards each other keeping parallel with the axis of the roller 43 and causing the plates 53a to close on each other towards the centre and thereby collect and clamp the rovings in a fan shape;

f) - immediately after this, the crossmember 54 is turned and, as it moves in the direction F', it meets the rovings in position 41" and carries them with it around and over the spindle into position 45'''. The rovings are then caught in the nip between the roller 43 and the spindle 45''', pulled round with it and so collected on the spool which is now beginning to form; in this step the rovings are also simultaneously broken at the clamping point of the rods 53, leaving free the spool underneath in position CA'. A new cycle of winding can then begin;

g) - the rods 53 are then opened and returned to the rest position, but they leave all the ends of the rovings gathered in the centre on the spool that has just been deposited on the support 51. This facilitates the work of the operator in the later operations of handling and of tying up to the spinning machine.

Figure 7 shows an alternative embodiment which in part is simplified in comparison with that shown in Figure 5, but which requires more floor space, for example up to 900 mm. Identical or equivalent parts are indicated here by the same reference numerals. The following therefore reappear:

- the guiding of the rovings 41 through the oscillating roving guides 44 and onto the roller 43,
- the feeding of the spindles 45 from a feeder 49, along the guides 49a, 49b as far as position 45''',
- the fixed vertical bar 50, the support 51 of the carriage 52 and the roving clamping rods 53, and
- the restarter bar 54 supported by the arms 55 and pivotable between a rest position (the broken lines in Figure 7) and an active position (solid lines in Figure 7) of placing the rovings around the spindle 45''' in the starting position.

This alternative also has the pair of arms 47 oscillating as one about the common axis 47a but does not have the arms 46. During the entire course of the winding, the spool CA is moving directly on the arms 47, which are held up in an inclined position (indicated in solid lines in Fig. 7). They are then swung downwards (arrow F) into position 47' only during the discharging of the completed spool, under the control of control means (not shown).

As stated, the pins 45a projecting from the ends of the spindle 45 rest freely on the top surface of the arms 47, on which they can rotate. Because of this support the spool CA moves automatically, as it grows in diameter, along the arm 47 towards the end furthest from the axis 47a. A shoulder or tooth 47b formed on the top edge of the oscillating arm 47 acts as a safety stop, specially in the starting position.

The way in which the device according to the variant shown in Figure 7 works is basically identical to that shown in Figure 5 and so it is not felt necessary to provide a further detailed explanation thereof. It should however be pointed out that since the pair of arms 46 and associated counterweight 56 are not provided, the supporting of the spool CA against the roller 43 is achieved purely by the weight of the spindle 45 itself and of the rovings that are wound upon it; it is not therefore possible, in contrast to the alternative shown in Figure 5, to provide automatic control

of the pressure of contact on the roller 43. The arms 47, which remain stationary in the raised position throughout the winding of the spool, are turned only once the winding has been completed, in a clockwise direction (by suitable motor means, not shown), and are lowered to discharge the spool CA.

Figure 8 shows still another alternative embodiment which, at least in certain respects, is also simplified: here too, parts identical or equivalent to those shown in Figure 5 are indicated by the same reference numerals. The following therefore reappear:

- the guiding of the rovings 41 through the oscillating roving guides 44 and on to the roller 43,
- the feeding of the spindles 45 from a feeder 49 along the guides 49a, 49b to position 45"',
- a pair of oscillating arms 46 which support the spindle in position 45"' and throughout the process of winding, and
- the support 51 of the carriage 52 and the roving clamping rods 53.

However, there are no oscillating arms 47 or fixed vertical bars 50, while the restarter bar 54 is shaped differently (see details below).

In this alternative, the arms 46, oscillating as one on the common axis 46a, are L-shaped: the top part of the L pivots at 46a and is basically rigid, while the lower part is formed by a telescopic part. This part, which during the winding of the spool CA is retracted, carries grips (not shown in any greater detail) at its ends for gripping the pin ends 45a of the spool.

As the diameter of the spool increases in the course of winding, the arms 46 swing anticlockwise from the starting position 46' to position 46" at the conclusion of the winding. Having reached this position, the arms 46 are again briefly swung towards the discharging position 46", where the spool CA is briefly separated from the roller 43 and is ready to be discharged.

The telescopic system of the lower part of the arm 46 is now actuated: it grows longer in a downward direction, as indicated by the dot-dash lines 46"", taking the spool to position CA' where it rests in the support 51 of the carriage 52.

With the spool now resting in position CA', the rods 53 are actuated to clamp the rovings and then - after the spool has been removed and a new spindle placed in position 45"' - the restarter bar 54 is operated.

In this alternative embodiment, the restarter bar 54 is not supported by oscillating arms (in contrast to the two embodiments shown in Figures 5 and 7) but engaged by its ends with a transporting system formed by two belts 61 travelling around rollers 62, at least one of which is powered.

When therefore an empty spindle is in the restarting position 45"', the belts 61 are caused to move in an anticlockwise direction and the crossmember 54 moves from the low position immediately above the rods 53, indicated by the solid lines, to the position 54' indicated by the broken line, following the path of the belts 61 and rollers 62, and therefore around the empty spindle 45"'.

A person skilled in the art will readily see that compared with the prior art, the arrangement of the condenser according to the invention has many advantages, which can be summarized as follows:

- better division of the card web owing to its vertical introduction between the take-in rollers: this is because in the prior art arrangements employing horizontal entry, the web comes into contact first with the tapes of the lower roller and these therefore take a greater load and are a source of defects in the count. The vertical entry of the invention automatically eliminates this problem;
- uniform support of the ribbons of web on all the tapes owing to their position beneath the vertex, with consequent elimination of the possible differences of count between the banks of one half and those of the other half of the condenser. This automatically eliminates the problem mentioned in point c) above, which involved a difference in count between the lower banks, where the web ribbon tended to separate from the tape and therefore became slacker, and the upper banks;
- the possibility of increasing the transverse stroke of the rubbing leathers, leading to an improvement in the quality of the rubbing - and this by any desired increase in the number of now vertical transport planes, without introducing difficulties either with regard to the opening out of the fan of rovings or even with regard to the removing and changing of the roving collection systems;
- possibility of increasing the space between one ribbon and the next in the same transporting plane, and likewise by an increase in the number of vertical transporting planes of the rubbing leathers, which can easily even exceed the eight of the embodiment illustrated;
- possibility of changing spools by fully automatic means, thus saving time during change-over and reducing the amount of labour; and
- possibility of changing all spools simultaneously and thereby guaranteeing an exact length on each spool.

## Claims

1. Condenser of card web in a card set, of the type

comprising a pair of horizontally adjacent take-in rollers, means for feeding the card web vertically to the rollers, a plurality of tapes guided around said rollers in alternating diverging directions to divide the card web into ribbons in a plurality of horizontally distributed banks, and means for feeding the ribbons vertically to a plurality of means for converting these ribbons into rovings suitable for handling and to roving collecting means, characterized in that said collecting means are linked up with change-over means and transporting means.

2. Condenser according to Claim 1, in which said means for converting the ribbons into rovings consist of pairs of rubbing leathers known per se arranged in a number of horizontally adjacent vertical rubbing planes.

3. Condenser according to Claim 1, in which said means for converting the ribbons into rovings consist of devices known per se capable of inserting a false twist and arranged in a number of horizontally adjacent vertical twisting planes.

4. Condenser according to Claim 1, in which said means for converting the ribbons into rovings consist of devices known per se capable of inserting a real twist and arranged in a number of horizontally adjacent vertical twisting planes.

5. Condenser according to Claim 1, in which said collecting means consist of spools for the winding of the rovings, the condenser being characterized in that said change-over means comprise, for each collecting spool, a support that oscillates between a loading and an unloading position, there being provided, in the loading position, actuating means for keeping the spool turning and means for feeding and distributing the roving to said spool.

6. Condenser according to Claim 5, in which said actuating means comprise, for each spool, at least one powered transfer roller whose length is equal to that of the collecting spool and whose axis is parallel to the axis of rotation of said spool, and said oscillating spool support keeps the spool in contact with the periphery of said cylinder throughout the winding process.

7. Condenser according to Claim 6, in which said oscillating support has pressure means for keeping the spool in contact with the transfer roller with a controlled pressure.

8. Condenser according to Claim 5 or 6, in which said feed means comprise, for each collecting spool, a plurality of roving guides, one for each of the rovings to be wound onto said spool, which roving guides are mounted so as to oscillate parallel with the axis of said transfer roller in order to feed and distribute the rovings to the periphery of the said roller.

9. Condenser according to Claim 5 or 6, in which said oscillating support is formed by at least one pair of supporting arms pivotably attached to a common shaft parallel with the axis of rotation of the collecting spool or of the transfer roller, said arms being provided with means for supporting the pin ends of the spool (Figures 5, 7 and 8).

10. Condenser according to Claim 9, in which said supporting means consist of grooves for holding the pin ends of the spool, said grooves being formed at the ends of said oscillating supporting arms, the axis of oscillation of these arms being located above the axis of the transfer roller in a position such that the open side of said grooves is face up in said spool loading position and face down in said spool discharging position (Fig. 5).

11. Condenser according to Claim 10, in which there is a counterweight acting on said oscillating supporting arms by way of pressure means for keeping said spool in contact with said transfer roller.

12. Condenser according to Claim 10, in which said first pair of supporting arms is accompanied by a second pair of guiding arms, the first pair supporting the spool during winding, from the loading position to the end-of-winding position, and the second pair guiding the spool from the end-of-winding position to the discharging position, means also being provided for transferring the spool from its position of support on said first pair of arms to that on said second pair of arms.

13. Condenser according to Claim 9, in which said supporting means consist of grips which are carried at the ends of the supporting arms and grasp the pin ends of the spool (Fig. 8).

14. Condenser according to Claim 13, in which said ends of the supporting arms are provided with a telescopic system for transferring the spool from an end-of-winding position to a lowered spool-discharging position.

15. Condenser according to Claim 13, in which said supporting arms pivot upon a shaft placed above

the axis of the transfer roller and the weight of the spool constitutes the pressure means for keeping said spool in contact with said transfer roller.

**16.** Condenser according to Claim 9, in which the supporting arms of the said pair are attached pivotably about a common axis positioned beneath the axis of said transfer roller and can move between a winding position in which they are inclined upwards and a discharging position in which they are inclined downwards, said means for supporting the pin ends of the spool being formed by the upper surface of said arms (Fig. 7).

**17.** Condenser according to Claim 16, in which the essentially rectilinear upper surface of said pair of arms defines an inclined plane permitting the free sliding and/or rolling of the pin ends of the spool, said inclined plane running uphill in the winding position and downhill in the discharging position.

**18.** Condenser according to Claim 12 or 17, also comprising a pair of fixed vertical retaining bars mounted at the two ends of the spool, said bars performing the function of retaining the pin ends of the spool and of guiding it down a vertical plane passing through a spool accommodating support onto said transporting means in the course of the oscillation from the end-of-winding position to the discharging position.

**19.** Condenser according to Claim 18, in which the upper ends of said retaining bars intersect with the ends of said pair of supporting arms in the end-of-winding position, while the lower ends of said bars are briefly separated from the ends of the supporting arms in the discharging position.

**20.** Condenser according to Claims 12 and 18, in which said vertical retaining bars constitute said means for transferring the position of support of the spools from said first to said second pair of arms.

**21.** Condenser according to Claim 5, also comprising means for gripping and clamping the rovings during the changing and removing of the full spool.

**22.** Condenser according to Claim 21, in which said roving gripping means are a pair of parallel clamping rods extending transversely to the axis of the transfer roller beneath which they are located, and able to move between a rest position in which they are located at the two ends of the line of rovings, and a clamping position in which they clamp the rovings in the centre, forming a fan.

**23.** Condenser according to Claim 5, in which said change-over means also comprise a feeder of empty spindles, the feeder being formed basically by a pair of feeder guides, each spindle being provided with supporting pins projecting from its ends so as to engage in said feeder guides.

**24.** Condenser according to Claim 23, in which said feeder guide is accompanied by control means for moving each spindle in succession through two positions resting on the periphery of the transfer roller, a first position for controlling the descent of the rovings and a second position for commencing the winding of the rovings around the spindle.

**25.** Condenser according to Claim 5, in which said transporting means consist of at least one carriage mounted so as to be movable along horizontal guides positioned beneath the condenser, said carriage being provided with a plurality of supporting saddles, each for one spool.

**26.** Condenser according to Claim 25, in which each of said supporting saddles is located, when in position for receiving a spool, underneath the respective transfer roller and laterally offset with respect thereto.

**27.** Condenser according to Claim 1 or 5, in which the card set is located largely at the same level as the condenser and said means for vertically feeding the card web to said take-in rollers consist of pairs of transporting belts or cloths having at least one path in common along which the card web is guided, held between adjacent belts or cloths, from the exit from the doffer to a position vertically above said pair of take-in rollers.

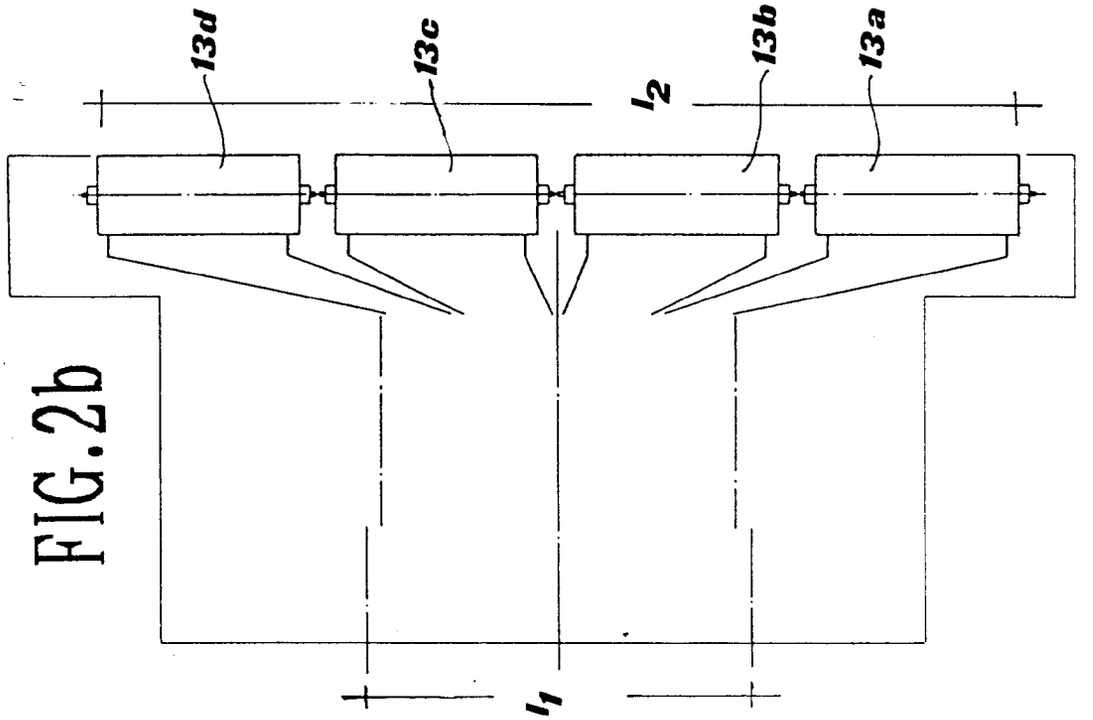



FIG.2b

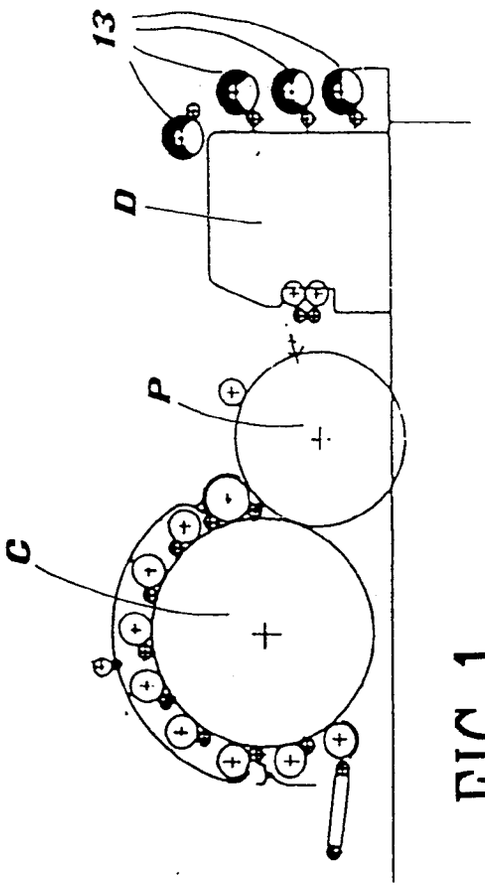



FIG.1

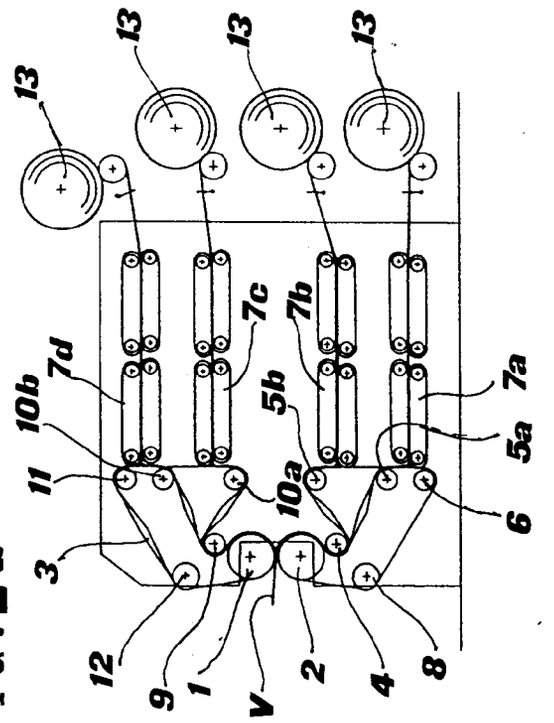
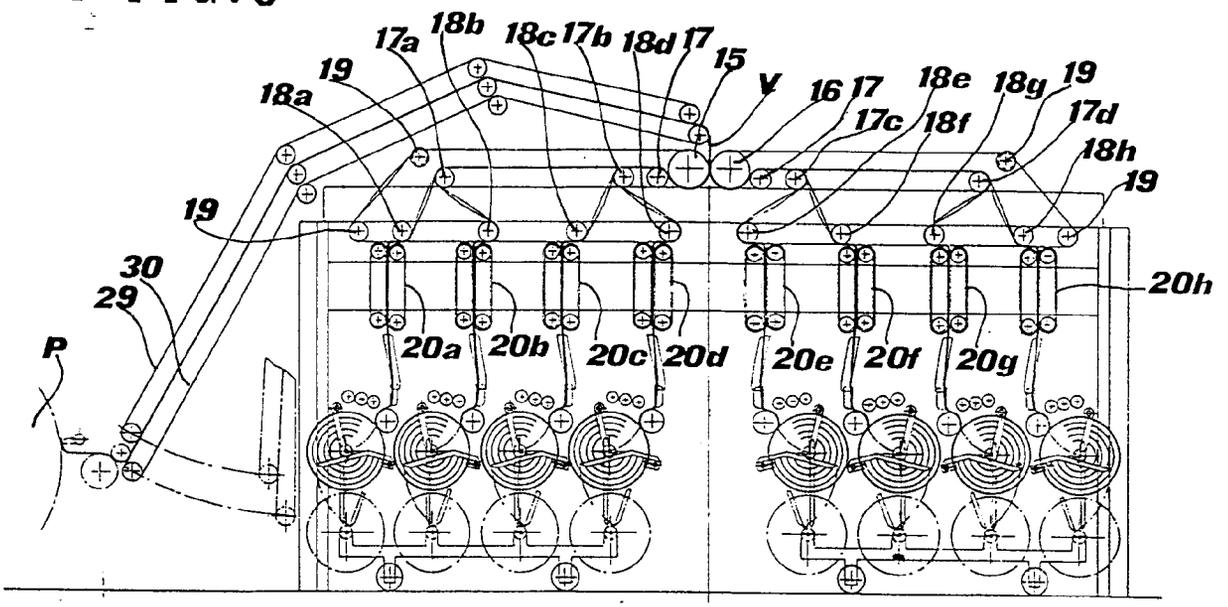



FIG.2a

FIG.3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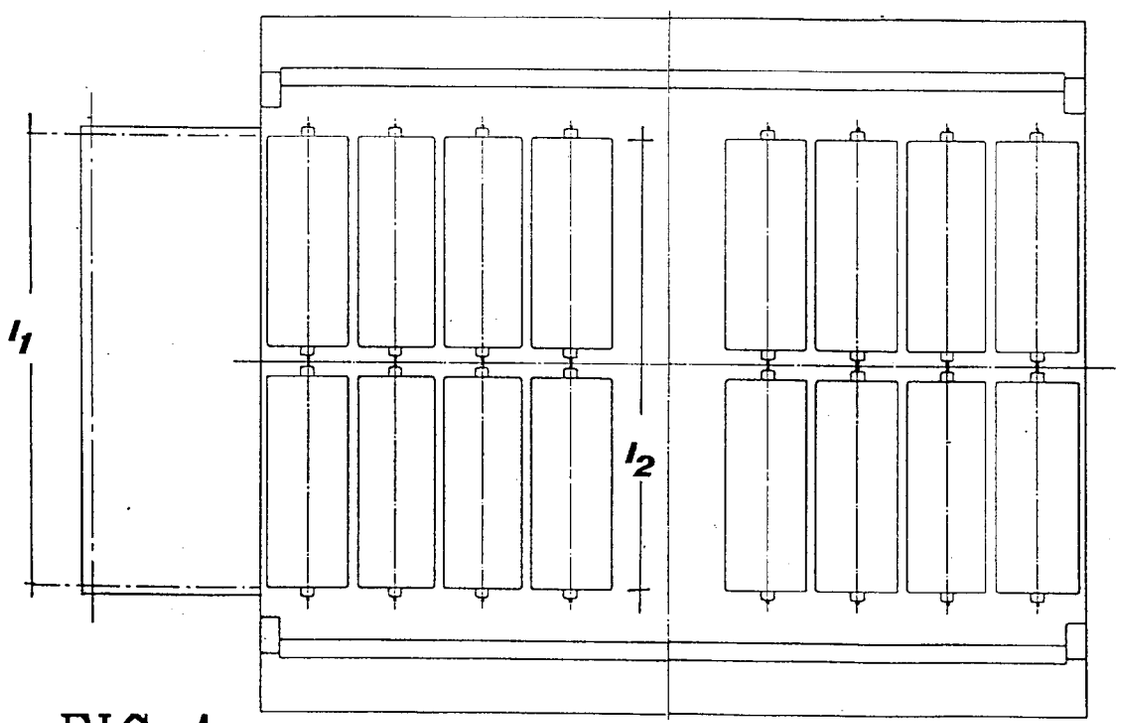
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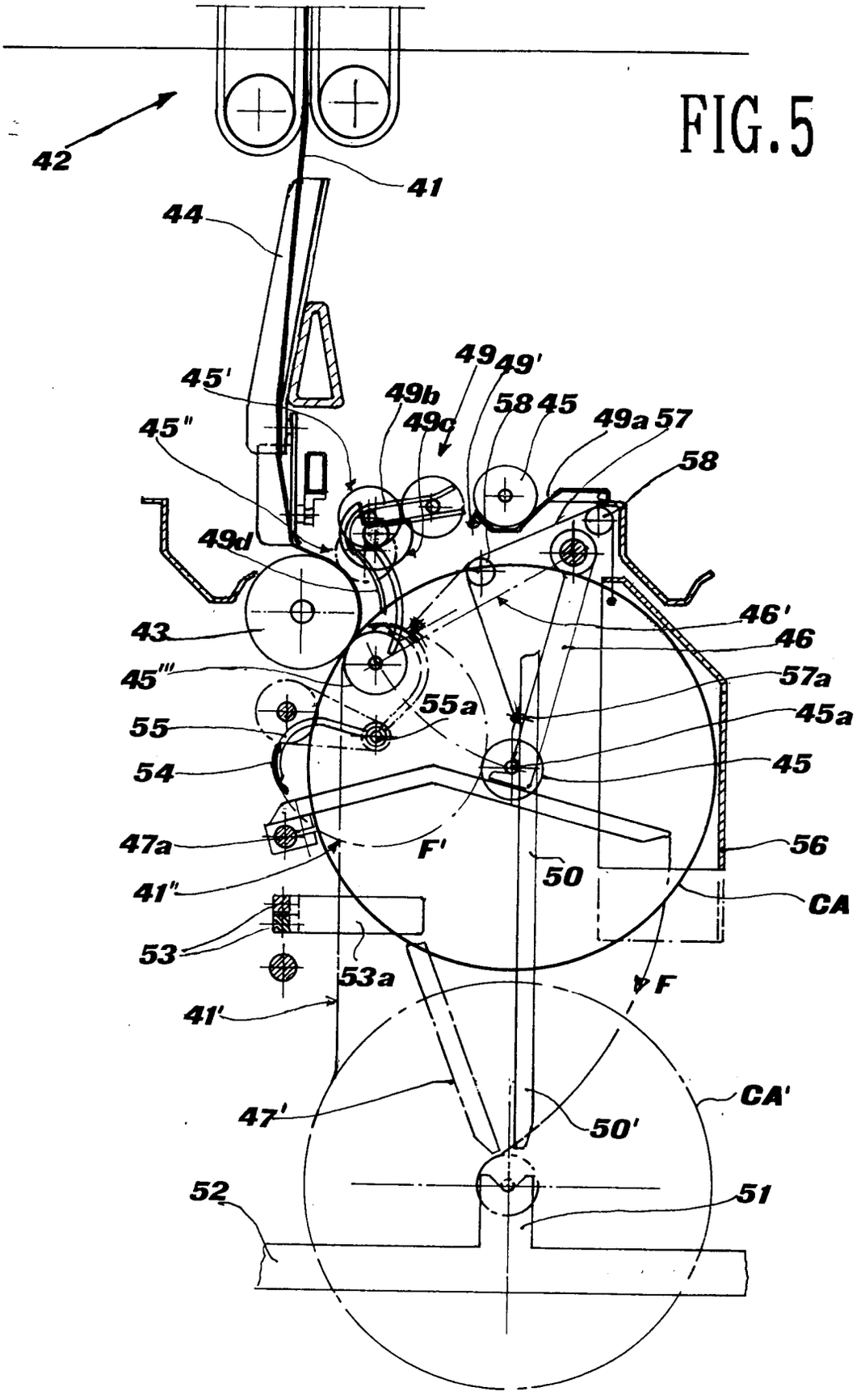
FIG.4

FIG.5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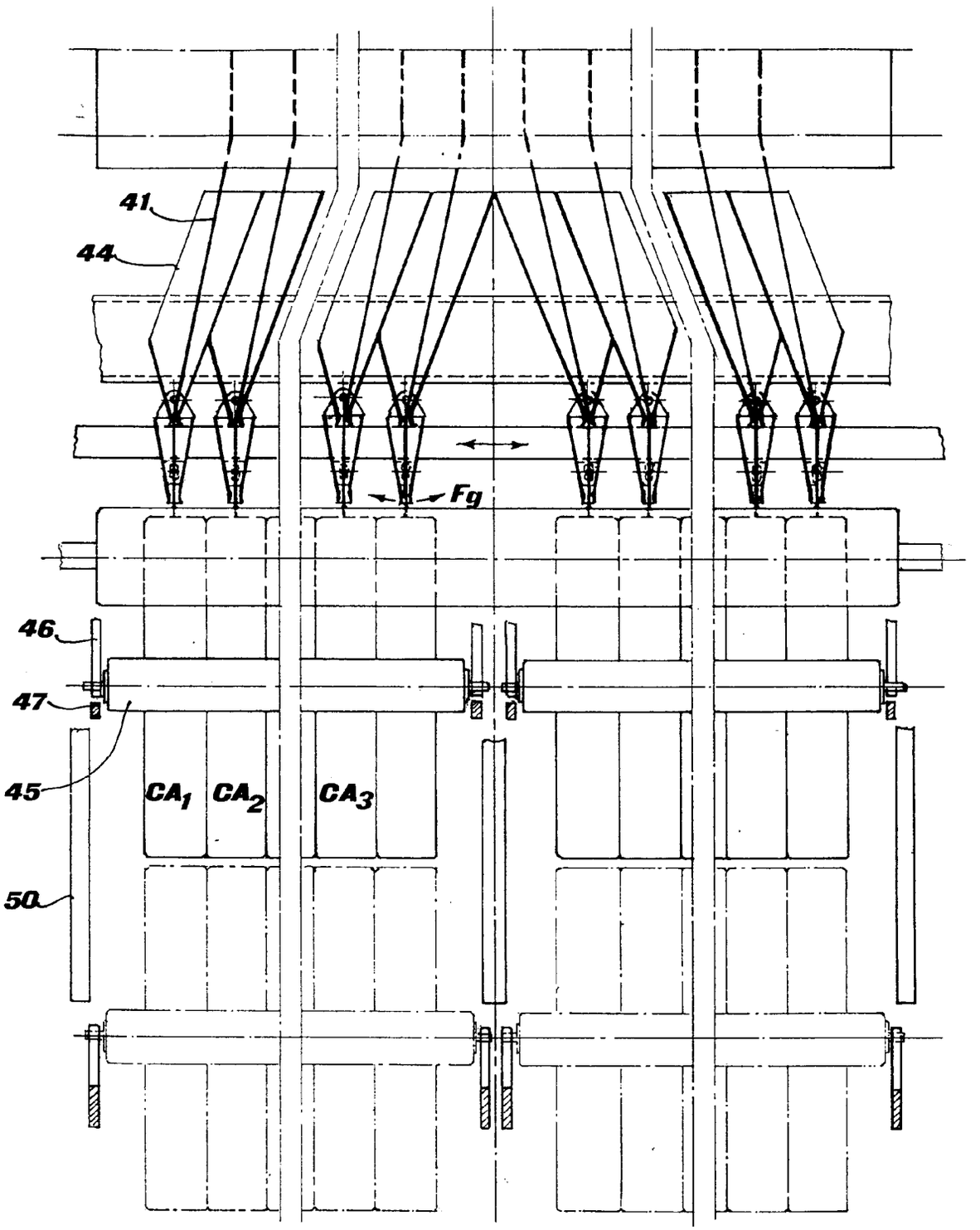


FIG.6

FIG.7

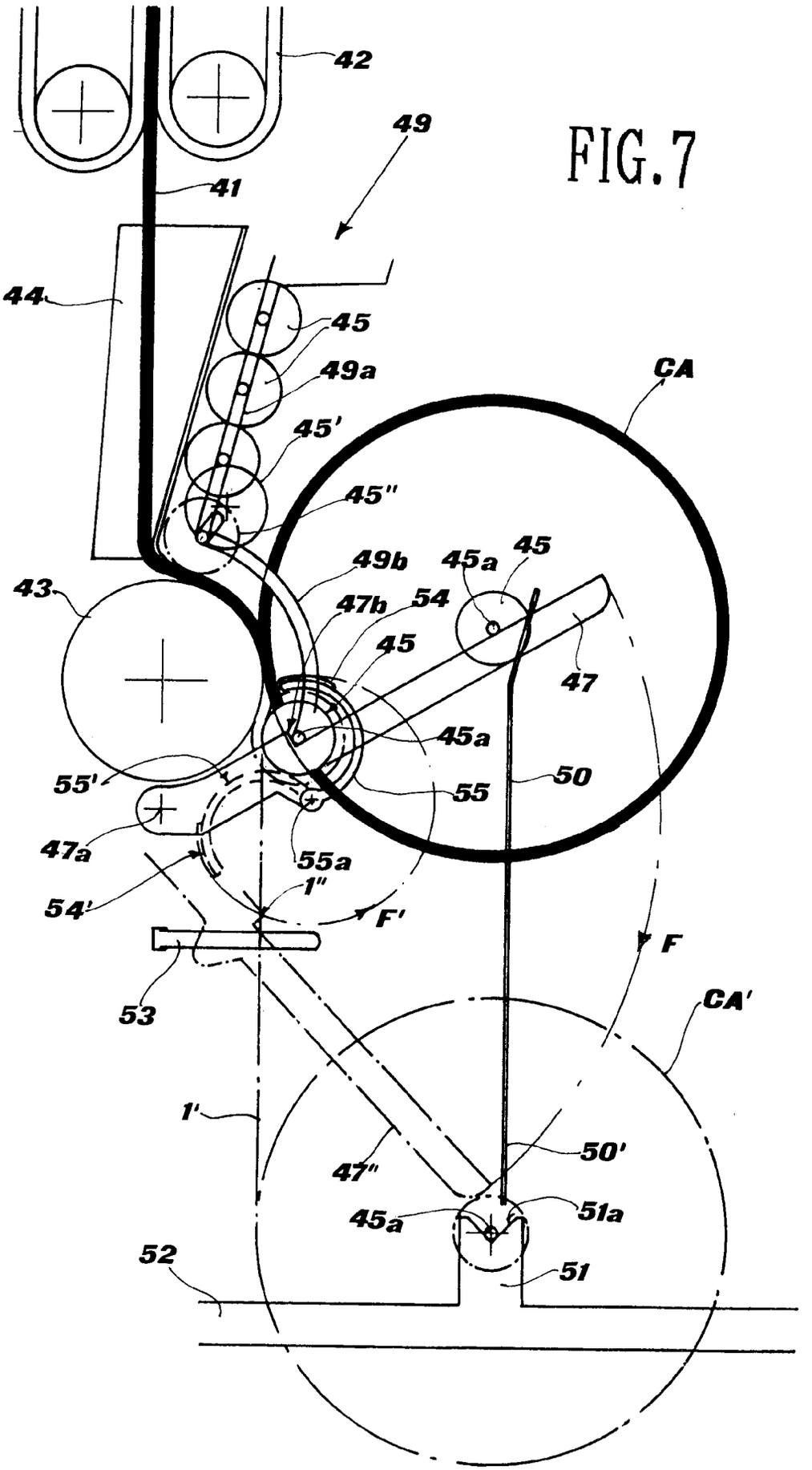
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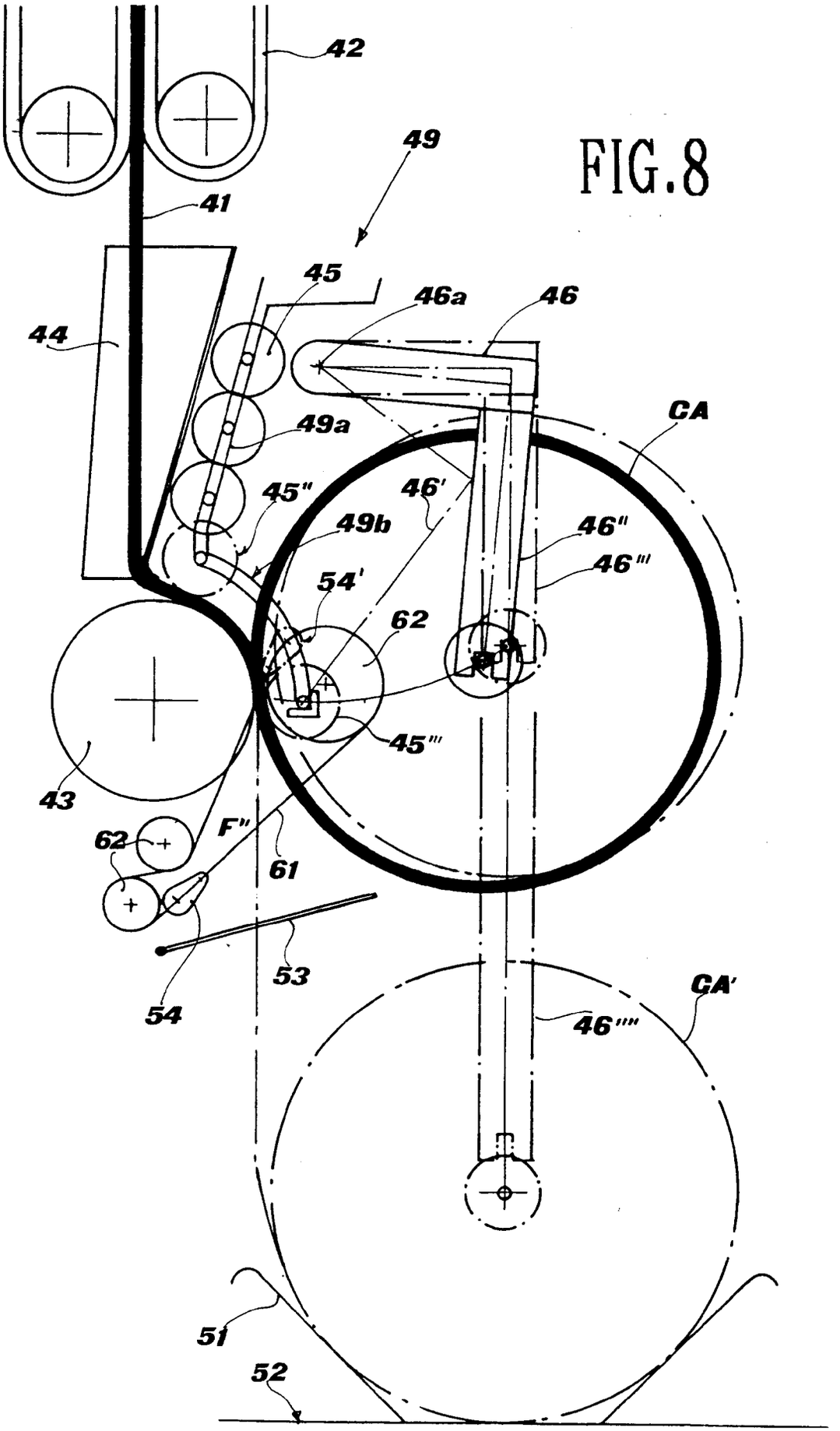
FIG.8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European Patent Office

# EUROPEAN SEARCH REPORT

Application Number
EP 94 10 0724

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int.Cl.5) |
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| A | | 27 | |
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| | ----- | | |

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| THE HAGUE | 27 April 1994 | Munzer, E |

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