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(54) A machine for manufacturing composite filters

(57) Filters of composite type for tipping cigarettes are manufactured on a twin track machine (1) with two garniture sections (6). Groups (4) of filter plugs (5) having different filtration properties are ordered in succession end to end and advanced lengthwise along feed directions (X1, X2) extending substantially parallel with one another and through a station (14) where each succession of groups (4) passes along a garniture tongue together with a plugwrap and is formed into a continuous rod (15). The two rods (15) proceed toward a rotary cutting head (16) by which they are divided up on a given cutting line (T) into single composite filters (2). To ensure that all the single composite filters turned out on both tracks will be identical, the axial position of each rod (15) is adjustable along the approach to the cutter head, by way of a feedback loop (19).

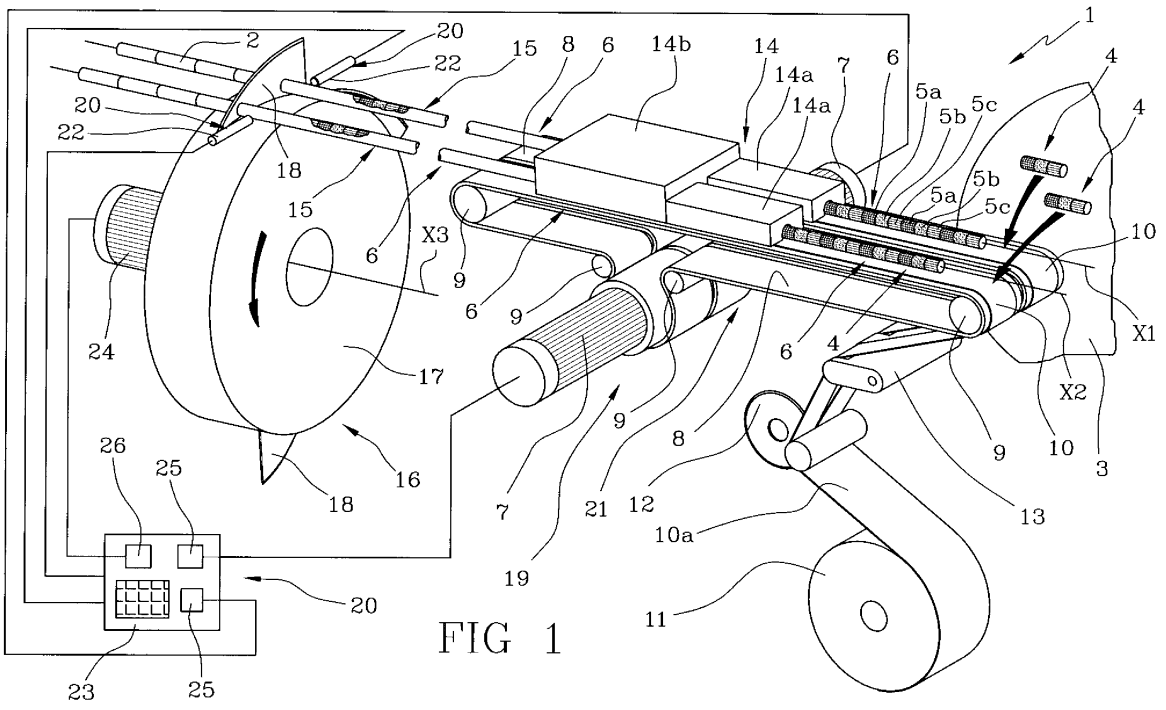

FIG 1

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Description

[0001] The present invention relates to a machine for the manufacture of composite filters.

[0002] Conventionally, the harmful effects of inhaling cigarette smoke are reduced by tipping cigarettes with composite filters, that is to say with filters obtainable by pairing together two or more filter plugs made of material having different filtration properties, which are joined permanently together by being enveloped in a single paper plugwrap.

[0003] The plugs, dispensed from respective reservoirs, are transferred by way of assembly machines with trains of fluted rollers, onto a common take-up roller presenting peripheral flutes.

[0004] Each of the take-up flutes accommodates a single composite filter element consisting in a group of two or more plugs having different properties, axially aligned and placed in end-to-end contact.

[0005] The assembled filter elements are then conveyed by rotary transfer means to a garniture section and fashioned into a composite filter rod.

[0006] Proceeding singly and in succession along the garniture section, the filter elements advance in end-to-end contact along a direction parallel with their longitudinal axis and are wrapped in a strip of paper material to form a continuous filter rod.

[0007] The rod is divided up subsequently into single composite filters by a rotary cutter operating at the outfeed end of the garniture section.

[0008] In reality, these machines of conventional type for manufacturing composite filters betray serious limitations in terms of production tempo.

[0009] More precisely, it has been found that they are not able to match the output speeds generated by cigarette makers and filter tip attachment machines of the latest generation, and therefore cannot be linked up directly to these same machines.

[0010] The object of the present invention is to provide a machine for manufacturing composite filters, such as will be unaffected by the above noted drawback.

[0011] A further object of the present invention is to provide a machine for making composite filters, such as will guarantee that the continuous rod is cut correctly and precisely to obtain a succession of filters identical one to the next.

[0012] The stated objects are realized, according to the present invention, in a machine for manufacturing composite filters of which the features are as recited in one or more of the appended claims.

[0013] The invention will now be described in detail, by way of example, with the aid of the accompanying drawings, in which:

- figure 1 is a perspective view of a machine for manufacturing composite filters in accordance with the present invention;
- figures 2 to 4 are plan views showing two enlarged details of the machine in figure 1 in a first succession of operating conditions;
- figures 5 to 7 are plan views showing the two enlarged details of figures 2 to 4 in a second succession of operating conditions.

[0014] With reference to figure 1, numeral 1 denotes a twin track filter maker, in its entirety, equipped to manufacture composite filters 2.

[0015] The machine 1 comprises an assembling unit, comprising an outfeed roller 3, of which the function is to prepare groups 4 of filter plugs 5 having different filtration properties.

[0016] In the example of figures 1 to 7, the groups 4 are composed of three plugs 5, each having a given filtration property, denoted 5a, 5b and 5c from left to right as viewed in figure 1, albeit the group might comprise any given number and any given combination of plugs 5.

[0017] The machine 1 further comprises two garniture sections 6 along which continuous rods of composite filters 2 are formed, each rod consisting in a succession of groups 4 of filter plugs 5.

[0018] The two garniture sections 6 extend respectively along mutually parallel longitudinal directions X1 and X2 and are supplied by the aforementioned assembling unit, which positions the groups 4 of three filter plugs 5 aligned axially in end-to-end contact.

[0019] In particular, each garniture section 6 comprises an electric motor 7 driving an endless garniture tape 8 looped around return pulleys 9, as shown in figure 1.

[0020] Numeral 10 denotes a continuous strip of paper material decoiling from a roll 11 and fed onto each tape 8, in which the filter plugs 5 are wrapped.

[0021] In the preferred embodiment of figure 1, a single strip 10a of paper plugwrap material is decoiled from a single roll 11 and divided longitudinally by a disc cutter 12 to provide two strips 10 for the two tracks of the machine.

[0022] Each of the two strips 10 is routed over a common idler element 13, illustrated in figure 1, before settling on the respective garniture tape 8.

[0023] The purpose of the idler element 13 is to ensure that both strips 10 are fed onto the tapes 8 at an identical and predetermined tension.

[0024] The paper strip 10a is drawn from the roll 11 at a constant tangential velocity determined by the linear feed velocity of the garniture tapes 8.

[0025] The successive groups 4 of filter plugs 5 are released by the assembling unit onto the strips 10 of paper drawn forward by the garniture tapes 8.

[0026] Each tape 8 carries the corresponding strip 10 of paper and the relative groups 4 of filter plugs 5 through a station 14 where the strip is wrapped progressively around the plugs and closed to form a tube, thereby generating two continuous rods 15 incorporating the groups 4 of filter plugs 5.

[0027] The station 14, which is schematized in figure 1, comprises a pair of garniture tongue devices 14a

(shown as blocks) by which the continuous strips 10 of paper are curled around the filter plugs 5, and a gumming device 14b (also shown as a block in figure 1) by which the two longitudinal edges of each paper strip 10 are glued together.

[0028] The continuous rods 15 fashioned in this way are advanced toward cyclic cutting means consisting of a cutter head 16, by which the selfsame rods 15 are divided by cuts made along a predetermined line T into single composite filters 2, each consisting in a group 4 made up of the three plugs 5a, 5b and 5c mentioned above. Importantly, and as discernible in the drawings, the cut must be made correctly on a line T coinciding with the join between the plugs denoted 5a and 5c of each continuous rod 15.

[0029] In particular, the cutter head 16 comprises a rotating drum 17 driven anticlockwise, as viewed in figure 1, by a respective motor 24. The drum 17 rotates about an axis X3 substantially parallel to the feed directions X1 and X2 of the continuous rods 15, and is equipped with two diametrically opposed blades 18 on its surface of revolution.

[0030] Each blade 18 is angled, in conventional manner, relative to the feed direction X1 and X2 of the two continuous rods 15.

[0031] The composite filters 2 obtained in this way are then conveyed to a further machine, namely a filter tip attachment machine (not illustrated), by which each composite filter 2 is joined to a respective cigarette stick.

[0032] Also forming part of the machine 1 are means 19 by which the position of the filter plugs 5 making up the continuous rods 15 can be adjusted relative to the stroke of the cutter head 16.

[0033] The adjustment means 19 in question will be interlocked to control means 20 monitoring the position of the constituent plugs 5 in the groups 4 of each continuous rod 15, relative to the stroke of the cyclic cutting means.

[0034] In the preferred embodiment illustrated, the adjustment means 19 operate on both the garniture sections 6 and comprise tensioning means 21, provided by the aforementioned motors 7, which act on the strips 10 of paper material by way of the garniture tapes 8.

[0035] By varying the speed of rotation of the motors 7 and thus tensioning or slackening one or both of the paper strips 10, in response to a signal from the control means 20, the axial position of the rods 15 can be governed and corrected.

[0036] Importantly, as already indicated, the strips 10 of paper material are drawn from the roll 11 at a constant tangential velocity, this same velocity in turn determining the rate at which the continuous rods 15 advance toward the cutter head 16, and therefore the number of composite filters 2 produced per unit of time.

[0037] The tension of the paper strips 10 can be varied by virtue of the fact that the plugwrap material presents a certain degree of elasticity.

[0038] In practice, importantly, the extent to which the paper strips can be elongated or contracted will be of the order of a few tenths of one millimetre, per decimetre of strip, in other words between 1‰ and 5‰ approximately.

[0039] The tension of the paper strips 10 is varied by marginally increasing or reducing the feed rate of the garniture tapes 8, on which the paper strips 10 are positioned and transported.

[0040] Accordingly, a slight increase (or reduction) in the linear velocity of a garniture tape 8 produces a marginal elongation (or contraction) of the corresponding paper strip 10 carried on the tape, given that the strip will continue to decoil from the roll 11 at the same tangential velocity.

[0041] The effect of elongating or contracting the paper strips 10 is ultimately to adjust the position of the groups 4 of filter plugs 5 making up the continuous rods 15, in such a way that the correct position of the cut line T can be maintained.

[0042] The control means 20 include a sensor 22 deployed near each continuous filter rod 15 and serving to monitor the passage of at least one plug 5 in each group 4.

[0043] More exactly, each sensor 22 reads the position of at least one filter plug 5 in each successive group 4 of the continuous rod 15, for example the plug denoted 5b, and relays a corresponding signal to a master control unit 23.

[0044] The control unit 23 comprises regulating means 25 designed to correct the speed of the motors 7 driving the garniture tapes 8.

[0045] The signal received by the control unit 23, which reflects the detected position of the plug 5b, is compared with a predetermined value reflecting the angular position of the cutter drum 17 and, should there be any misalignment between the detected position and the prescribed position of the filter plug 5b, the unit 23 will respond in feedback mode by correcting the speed of the motors 7 driving the garniture tapes 8 through the agency of the regulating means 25.

[0046] To this end, the motors 7 are equipped with a differential allowing their speed of rotation to be increased or reduced.

[0047] To guarantee a correct positional reading of the filter plug 5, the sensors 22 are located in the immediate vicinity of the cutter head 16, as shown in the figures of the accompanying drawings.

[0048] To reiterate, the sensors 22 are able to detect and identify the position of filter plugs 5 already enveloped by the strip 10 of plugwrap material.

[0049] One type of sensor suitable for the purpose in question, by way of example, would be a sensor 22 receptive to a particular kind of material such as graphite, from which the filter plug 5b is made.

[0050] Alternatively, the sensors 22 could be of a type able to measure the density of each filter plug 5 and thereby detect its relative position internally of the continuous rod 15.

[0051] Observing figures 2 to 7, it will be seen that the two continuous rods 15 are illustrated in such a way as

to show the filter plugs 5 internally of the wrap. The line denoted T represents the line on which the continuous rods 15 are severed by the blades 18 of the cutter drum 17.

[0052] The right hand part of each figure 2...7, as viewed in the drawings, illustrates portions of the two garniture tapes 8 with the relative strips 10 of paper plug-wrap material transported by them, and the filter plugs 5 placed on the strips 10. Figure 2, in particular, indicates a situation in which the filter plugs 5 of one continuous rod 15, and more exactly the rod uppermost in the drawing, are retarded relative to the corresponding plugs 5 of the other rod 15, whilst the plugs of the latter rod are positioned correctly in relation to the line T of the cut.

[0053] In this situation, the two streams of composite filters 2 generated by the cutter head 16 will be different one from another, and in particular, the filters cut from the upper rod 15 of the drawing will be defective, since they are not separated by the cutter head 16 at the point of contact between the endmost plugs 5c and 5a of successive groups.

[0054] The retard is detected by the sensors 22 and a signal is relayed to the control unit 23, which responds by piloting the speed regulating means 25 to increase the linear velocity of the garniture tape 8 carrying the filter rod 15 not positioned correctly relative to the line T of the cut.

[0055] As a result, the paper strip 10 is tensioned for a predetermined interval and in such a way as to induce an elastic elongation, suitably attenuated to ensure the material will not tear.

[0056] The feed rate of the garniture tape 8 in question is maintained marginally higher than that of the other tape, so that successive segments of the paper strip 10 will be elongated.

[0057] Accordingly, with segments of the strip 10 being elongated by small amounts one after another, the effect will be to align the plugs 5 of the retarded rod with the plugs of the other rod 15, correctly positioned, as illustrated in figures 3 and 4.

[0058] At this point, a corresponding signal is relayed by the sensors 22 to the control unit 23, which responds by synchronizing the speeds of the two motors 7, and therefore of the garniture tapes 8.

[0059] Composite filters 2 cut during the realignment of the two rods 15 are rejected.

[0060] Figures 5 to 7 illustrate a situation in which the groups 4 of filter plugs 5 belonging to both rods 15 are positioned incorrectly, the ones advanced and the others retarded in relation to the prescribed cutting position.

[0061] In this instance, the errors can be corrected in either of two ways.

[0062] A first option is that when the sensors 22 relay respective signals to the control unit 23, the unit responds by accelerating the motor 7 relative to the lower rod 15 in the drawing (retarded) and decelerating the motor 7 relative to the upper rod 15 (advanced). The corrective action will continue until the errors are cancelled out.

[0063] A second option is to vary the speed of just one motor 7 in such a way as to render the two errors identical, that is to say, aligning the plugs 5 of the two rods so that the sensors 22 read the same amount of drift from the correct position in both rods, at the moment of the cutting stroke.

[0064] At this point, the two identical errors can be corrected by varying the angular velocity of the cutter drum 17.

[0065] The speed of the cutter head 16 is varied by way of further control means 26 forming part of the master control unit 23 and able to regulate the speed of the motor 24 driving the cutter head 16.

[0066] In conclusion, the aforementioned means 25 by which to regulate the speed of the motors 7 driving the garniture tapes 8, and the means 26 by which to regulate the speed of the motor 24 driving the cutter head 16, function as means for correcting the axial position of the garniture tapes 8 and/or the timing of the cyclic cutting means 17.

Claims

1. A machine for manufacturing composite filters, **characterized in that** it comprises:

   - two garniture tapes (8) by which two continuous filter rods (15) are advanced parallel one with another at a predetermined rate along respective feed directions (X1, X2) through the agency of respective drive means (7), each rod (15) formed as a succession of composite filter plugs (5) ordered in groups (4) and wrapped in a continuous strip of paper (10), each group (4) comprising at least two plugs having different filtration properties;
   - cyclic cutting means (16), set in motion by respective drive means (24), by which the two rods (15) are divided into single composite filters (2);
   - means (20) by which to control the position of the single constituent groups (4) of the rods (15) relative to the stroke of the cutting means (16).

2. A machine as in claim 1, wherein control means (20) comprise sensors (22) occupying a predetermined position along the path of the garniture tapes (8) and emitting first signals on detection of the single groups (4), also a control unit (23) by which the first signals are compared with corresponding second signals indicating the timing of the cutting means (16), comprising means (25, 26) by which to correct the axial position of garniture tapes (8) and/or the timing of the cyclic cutting means (16).

3. A machine as in claim 2, wherein correction means comprise means (25) by which to regulate the speed

of the drive means (7) associated with the garniture tapes (8).

4. A machine as in claim 2 or 3, wherein correction means comprise means (26) by which to regulate the speed of the drive means (24) associated with the cutting means (16).

5. A machine as in claims 2 to 4, wherein sensors (22) consist in means able to detect the presence of at least one of the filter plugs (5) making up the group (4).

6. A method of manufacturing composite filters, **characterized**
in that it comprises the steps of:

- utilizing two garniture tapes (8) to feed two continuous filter rods (15), each fashioned as a succession of composite filter plugs (5) assembled in ordered groups (4) and wrapped in a continuous strip (10) of paper material;
- utilizing cyclic cutting means (16) to divide both continuous rods (15) into single composite filters (2);
- utilizing sensors (22) to detect the passage of single groups (4) making up each rod (15), at a predetermined position;
- regulating the speed of the garniture tapes (8) in such a manner as to adjust the position of the groups (4) relative to the cyclic stroke of the cutting means (16).

7. A method of manufacturing composite filters, **characterized**
in that it comprises the steps of:

- utilizing two garniture tapes (8) to feed two continuous filter rods (15), each fashioned as a succession of composite filter plugs (5) assembled in ordered groups (4) and wrapped in a continuous strip (10) of paper material;
- utilizing cyclic cutting means (16) to divide both continuous rods (15) into single composite filters (2);
- utilizing sensors (22) to detect the passage of single groups (4) making up each rod (15), at a predetermined position;
- regulating the speed of at least one garniture tape (8) so as to render the axial positions of the groups (4) of filter plugs (5) identical, relative to the cutting means (16) ;
- regulating the speed of the cutting means (16) so as to adjust the position of the groups (4) making up both continuous rods (15), relative to the cyclic stroke of the cutting means (16).

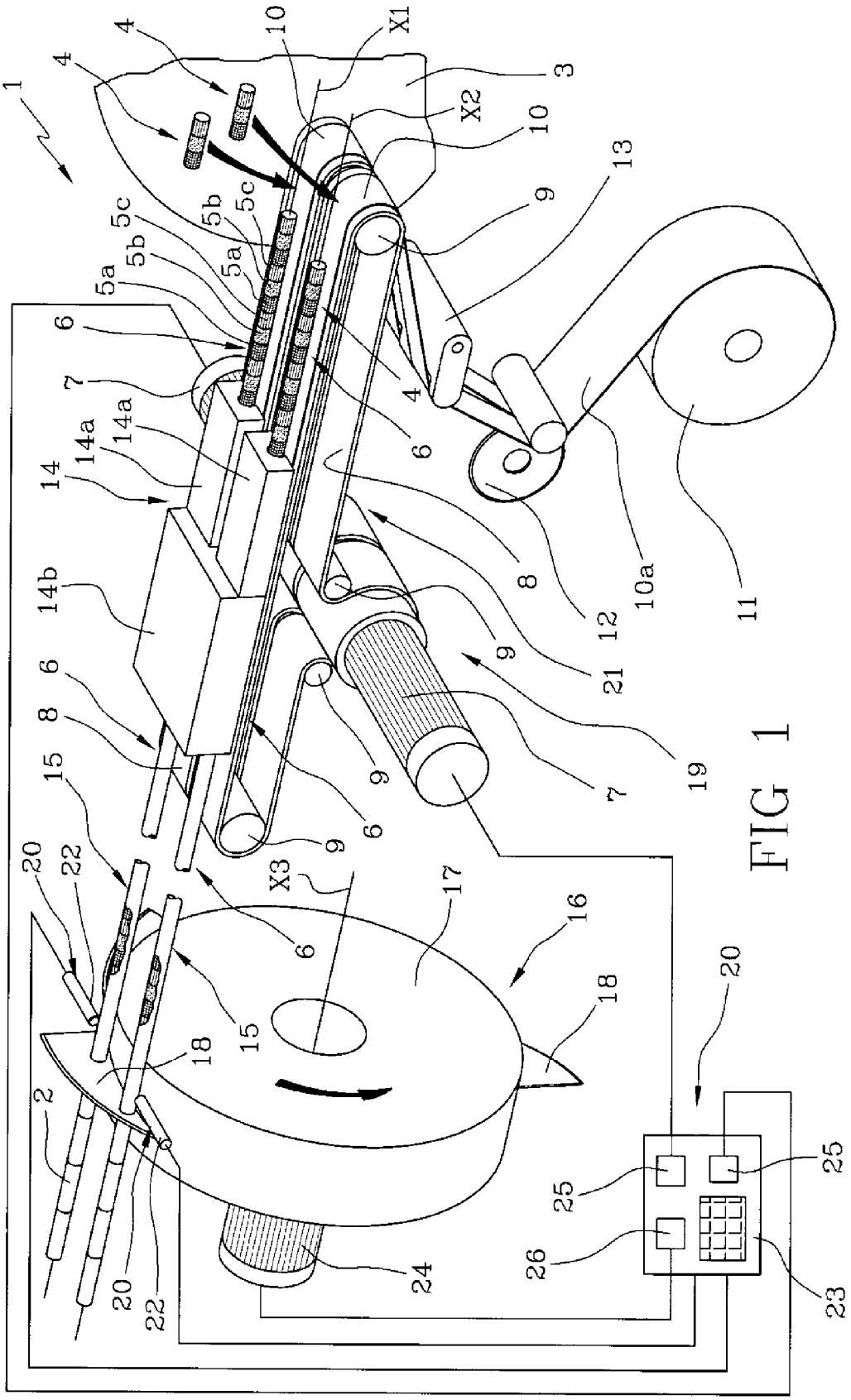
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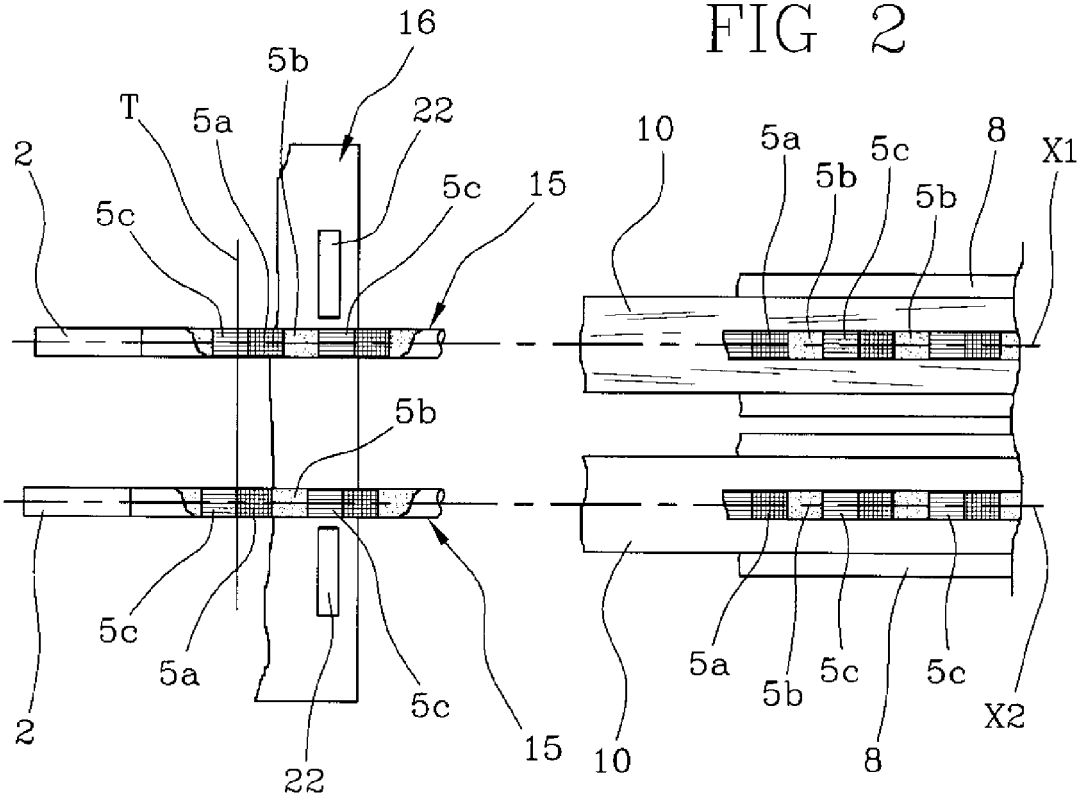
FIG 1

FIG 2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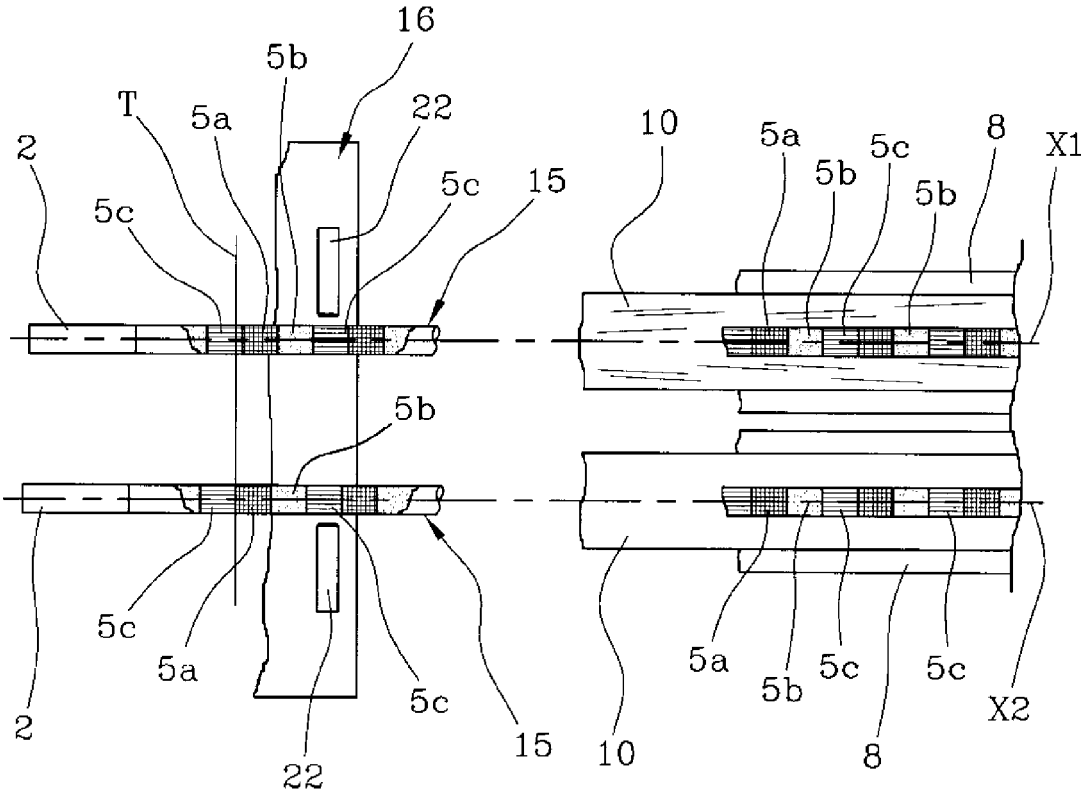
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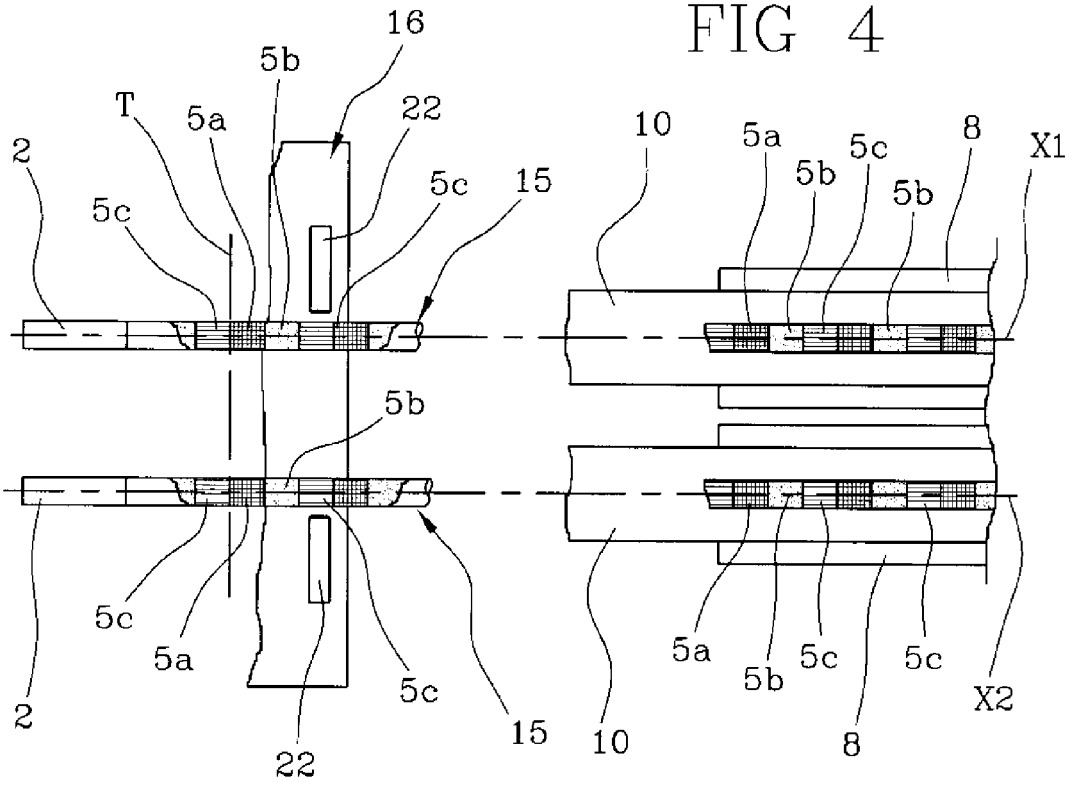
FIG 3

FIG 4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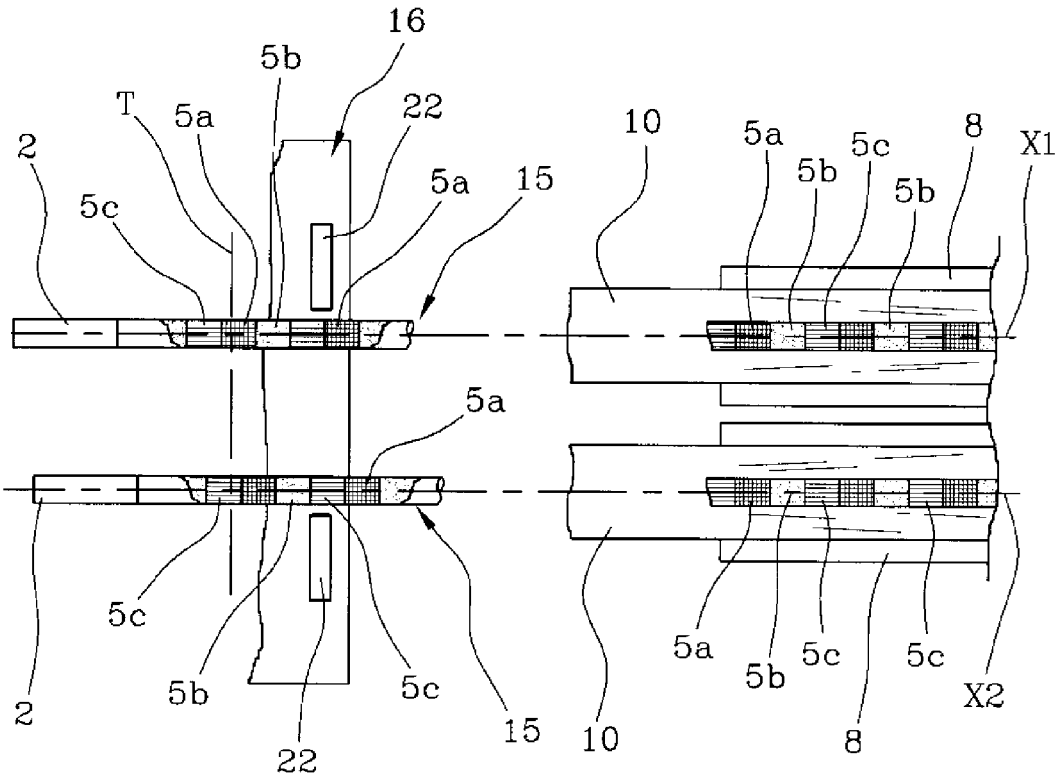
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FIG 5

FIG 6

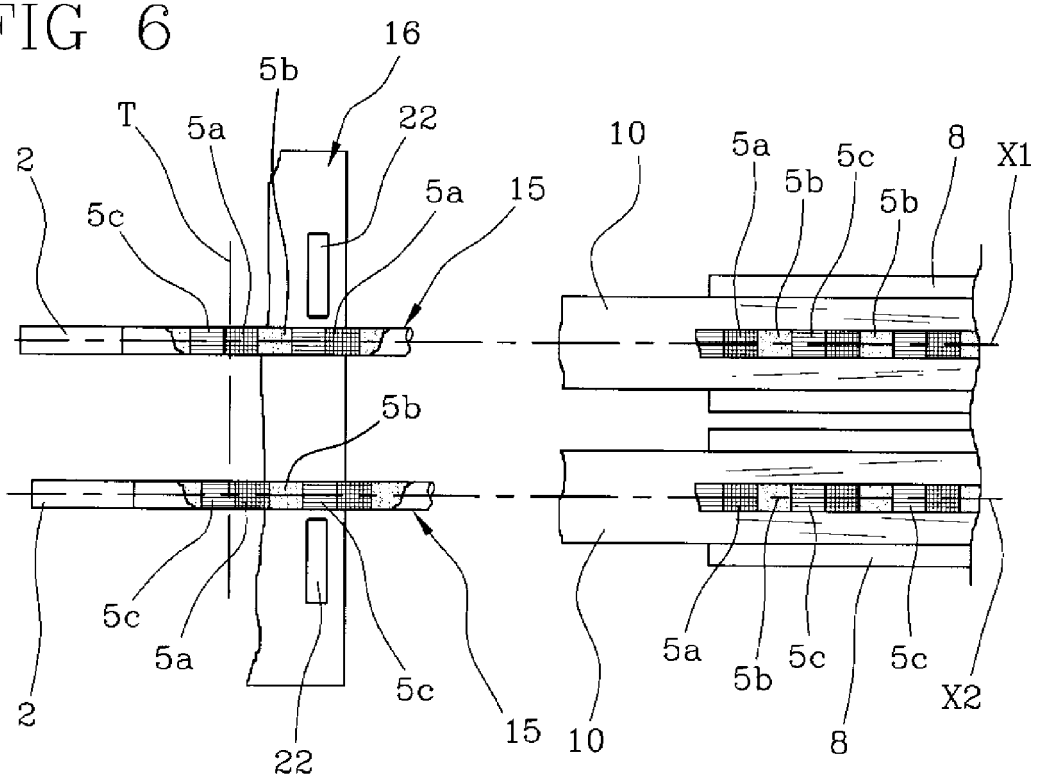
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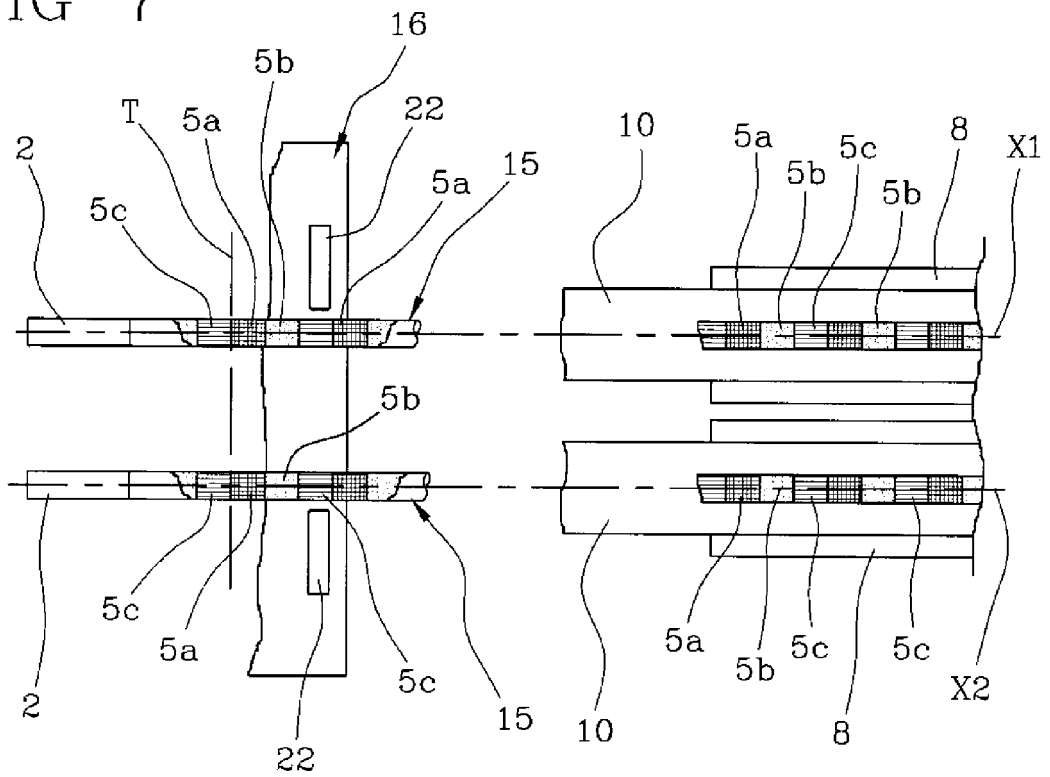
FIG 7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EUROPEAN SEARCH REPORT

Application Number
EP 07 11 8327

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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
Munich	11 February 2008	MARZANO MONTEROSSO

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