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(54) Machine for processing substantially cylindrical tobacco articles, control device, and diagnostic method applied to such a machine

(57) A machine for processing cigarettes (2), a control device (5), and a diagnostic method applied to such a machine (1); the machine (1) has a number of housings (10) oriented crosswise to a feed path (P1) and each having at least two respective elongated seats (11, 11'); during each operating cycle, each seat (11, 11') picks up a respective cigarette (2) at an input station (4), releases the cigarette at an output station (6), and returns to the input station (4) along a return path (P2); a proximity sensor (14, 14') determines the position of the seats (11), and emits a recording signal (S) which is processed and compared with reference data (DR) to determine a possible fault.

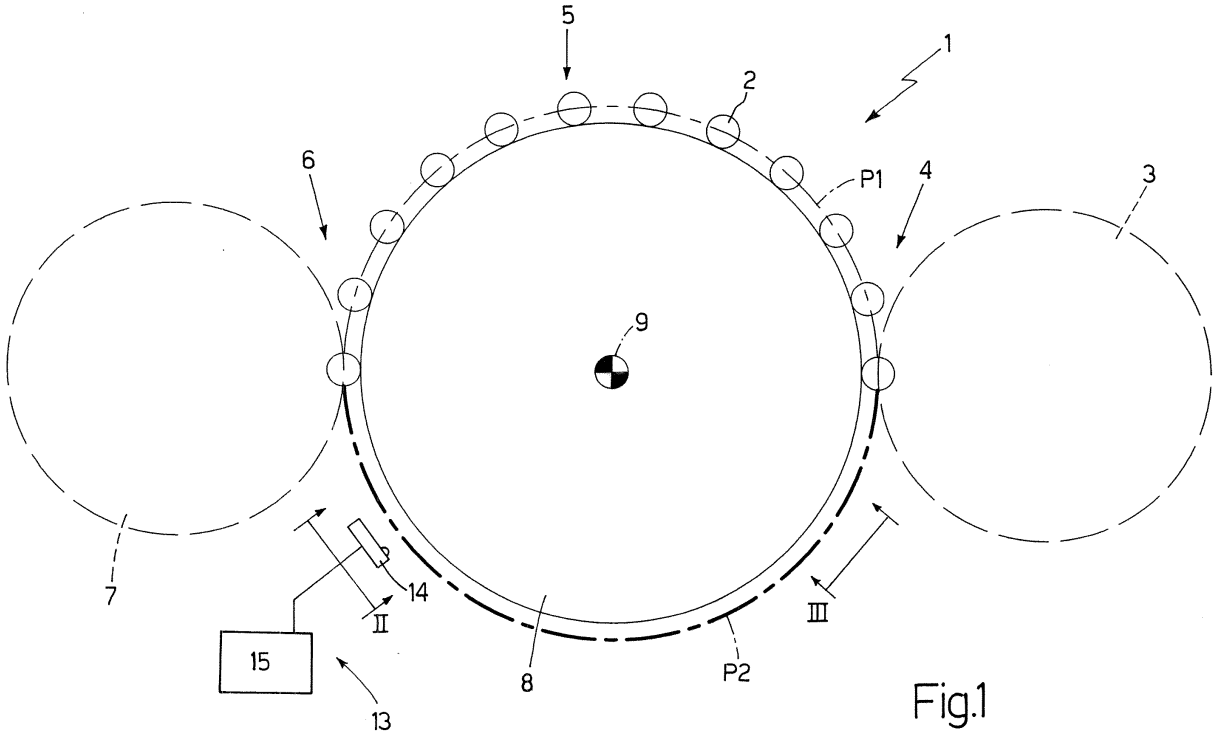

Fig.1

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Description

[0001] The present invention relates to a machine for processing articles, a control device, and a diagnostic method applied to such a machine.

[0002] More specifically, the present invention relates to a machine for processing articles and comprising a transfer device, which feeds the articles along a feed path from an input station to an output station, and comprises at least one seat and at least one operating component for moving the seat. During each operating cycle, the seat picks up a respective article at the input station, releases the article at the output station, and returns to the input station along a return path.

[0003] In known machines of the above type, it is relatively essential that the seat assume a precise position at the input and output stations to prevent the article from being damaged or even lost as it is picked up or released by the seat.

[0004] At present, faults on the transfer device resulting in incorrect positioning of the seats at the input and/or output station are extremely difficult and slow to determine. This, combined with the high operating speeds of modern machines for processing articles, therefore results in a relatively large number of rejects downstream from the transfer device and, consequently, in increased production costs.

[0005] It is an object of the present invention to provide a machine for processing articles and a diagnostic method, which are designed to eliminate the aforementioned drawbacks, and which, in particular, are cheap and easy to implement.

[0006] According to the present invention, there is provided a diagnostic method as claimed in any one of the independent Claims relating to the method, and preferably in any one of the Claims depending directly or indirectly on said independent Claims.

[0007] According to the present invention, there is provided a machine for processing articles, as claimed in any one of the independent Claims relating to the machine, and preferably in any one of the Claims depending directly or indirectly on said independent Claims.

[0008] According to the present invention, there is provided a control device as claimed in the Claim relating to the device.

[0009] A number of non-limiting embodiments of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a schematic front view of a machine for processing articles, in accordance with the present invention;

Figure 2 shows a detail of the Figure 1 machine in a first operating position;

Figure 3 shows the Figure 2 detail in a further operating position;

Figure 4 shows a reference curve and a recorded signal test curve; the x axis shows the machine angles, and the y axis the intensity of the signal;

Figure 5 shows a time graph of test data and/or comparison data;

Figure 6 shows a schematic view in perspective of a further embodiment of the Figure 1 machine;

Figure 7 shows a larger-scale detail of Figure 6;

Figure 8 shows a reference signal test curve; the x axis shows the machine angles, and the y axis the intensity of the signal;

Figure 9 shows a recorded signal test curve; the x axis shows the machine angles, and the y axis the intensity of the signal;

Figures 10-12 show a detail of the Figure 6 machine in successive operating positions.

[0010] Number 1 in Figure 1 indicates as a whole a machine for processing cylindrical tobacco articles, in particular cigarettes 2. The machine comprises a feed conveyor 3 for feeding cigarettes 2 to an input station 4; a transfer device 5 for transferring cigarettes 2 from input station 4 to an output station 6 along a feed path P1; and a conveyor wheel 7 for receiving cigarettes 2 from transfer device 5 at output station 6.

[0011] Transfer device 5 comprises a conveyor roller 8, which rotates about a respective horizontal axis of rotation 9 and has a number of peripheral housings 10 equally spaced about axis 9 and each comprising two elongated, substantially coaxial seats 11 and 11', each having an externally concave surface with suction nozzles. Roller 8 comprises an operating unit 12 (shown partly) for moving seats 11 and 11' longitudinally and parallel to axis 9, and which comprises a number of rods 12'. Each rod 12' supports a respective seat 11 and 11', and slides longitudinally in a direction parallel to axis 9.

[0012] In the tobacco industry, transfer device 5 is normally used to part two cigarettes 2 just formed by transversely cutting a double cigarette (not shown).

[0013] In actual use, when a housing 10a, comprising two seats 11a and 11'a, is located at input station 4, the two seats 11a and 11'a receive respective cigarettes 2 positioned with the respective filter ends facing. At this point, as roller 8 rotates about axis 9 and housing 10a travels along path P1, seats 11a and 11'a are parted axially and parallel to axis 9 (Figure 2) until they reach output station 6, where cigarettes 2 are released onto conveyor wheel 7. As housing 10a returns to input station 4 along a return path P2, the two seats 11a and 11'a are brought back together again (Figure 3).

[0014] Machine 1 also comprises a control device 13 for ensuring seats 11, 11' are positioned correctly along feed and return paths P1 and P2. Control device 13 comprises two proximity sensors 14, 14', each for emitting a recording signal S relative to the position of a respective seat 11, 11' of each housing 10; and a computer 15 connected to sensors 14, 14' and for comparing recording signal S with a reference data item DR to obtain at least one comparison data item DC from which to determine a fault on operating unit 12.

[0015] In the present description, the term "fault" is intended to mean an operating condition which is already causing production problems, e.g. a relatively high percentage of reject cigarettes, or a condition which, if not corrected, would presumably result in production problems.

[0016] As described herein, reference data item DR may comprise one or more elements, e.g. may be a single value or a matrix of values. Similarly, comparison data item DC may comprise one or more elements, e.g. may be a single value or a matrix of values.

[0017] Computer 15 may acquire a recorded data item as a function of recording signal S and subtract the recorded data item from a reference data item DR value to obtain a comparison data item DC value; and, in the event the comparison data item DC value exceeds a given threshold value, control device 13 informs the user of the fault by means of acoustic and/or visual signals and/or stops machine 1.

[0018] With reference to one seat 11a, in actual use, proximity sensor 14 emits a signal Sa every time seat 11a travels past sensor 14. Signal Sa has a peak PR indicating the minimum distance between seat 11a and proximity sensor 14, and which has a respective recorded height h, and a minimum machine angle AM corresponding to the instant in which peak PR is recorded. Computer 15 preferably processes signal Sa from sensor 14 to obtain a response curve C1 (shown in Figure 4) indicating distances between seat 11a and sensor 14 as a function of machine angles of transfer device 5.

[0019] More specifically, given the externally concave surface of seat 11a, curve C1 is substantially W-shaped, and has peak PR and a groove GR, which indicates the maximum distance between the seat and the sensor, and which has a respective recorded height h'.

[0020] In the present description, the term "machine angle" is intended to mean a given point in an operating cycle at which transfer device 5 assumes a given operating configuration typical of that point. If transfer device 5 is operated at constant speed, the same machine angles of successive operating cycles follow one another at constant time intervals of a duration equal to the duration of one operating cycle.

[0021] In some embodiments, peak PR is compared with reference data item DR to obtain comparison data item DC. In particular, recorded height h may be compared with reference data item DR to determine the correct radial position of seat 11a with respect to axis 9; and minimum machine angle AM may be compared with reference data item DR to determine the correct angular position of seat 11a with respect to axis 9.

[0022] Alternatively or in addition, reference data item DR comprises a reference curve C2; and computer 15 compares response curve C1 with reference curve C2 to obtain comparison data item DC comprising information relating to the angular and radial position of seat 11a with respect to axis 9.

[0023] Alternatively or in addition, computer 15 determines a neighbourhood of peak PR having a given area A, and identifies a mid-line M of area A (i.e. a line dividing area A into two portions of equal area) having a constant minimum machine angle T1, which is compared with reference data item DR (e.g. the machine angle of a mid-line of curve C2) to obtain comparison data item DC comprising information relative to the angular position of seat 11a with respect to axis 9.

[0024] Alternatively or in addition, computer 15 determines the recorded height h' of groove GR; and recorded height h' is compared with reference data item DR to obtain comparison data item DC comprising information relative to the radial position of seat 11a with respect to axis 9.

[0025] In a further embodiment, alternatively or in addition to the above, curve C1, peak PR, groove GR, machine angle AM, mid-line M, machine angle T1, recorded height h and/or recorded height h' are calculated by computer 15 on the basis of the mean of a number of signals Sa emitted by sensor 14 during successive operating cycles.

[0026] It should be pointed out that, in the present description, the operations referred to as being performed by computer 15 on recording signals S (e.g. comparisons, mean calculations, and time patterns) are intended as being performed directly on recording signals S or on the processing (acquired data) of recording signals S.

[0027] Alternatively or in addition, during each operating cycle, computer 15 compares curve C1, peak PR, groove GR, machine angle AM, mid-line M, machine angle T1, recorded height h and/or recorded height h' with reference data item DR to obtain a number of comparison data items DC, each relating to a respective operating cycle; and computer 15 determines and employs a mean of said comparison data items DC to identify a possible machine fault.

[0028] In a further embodiment, in addition to or instead of the above embodiments, one or more test curves are determined by which to extrapolate the time pattern of at least one of the following data items: curve C1, peak PR, groove GR, machine angle AM, mid-line M, machine angle T1, recorded height h, recorded height h' (i.e. the recorded data) and/or comparison data item DC. Maintenance work is programmed as a function of the instants in which one or more test curves intersect respective reference curves of reference data item DR. More specifically, maintenance may be programmed at the exact instant in which a test curve intersects the respective reference curve, or at a given time interval before or after the instant in which a test curve intersects the respective reference curve.

[0029] Purely by way of example, Figure 5 shows a test curve, in which time is shown along the y axis, and the x axis shows at least one of the following data items: curve C1, peak PR, groove GR, machine angle AM, mid-line M, machine angle T1, recorded height h, recorded height h' and/or comparison data item DC. K and R in Figure 5 indicate a test curve and reference curve re-

spectively.

[0030] As shown in Figure 5, test curves K are preferably linear, and reference curves R preferably each define a respective constant value.

[0031] By comparing at least one of recorded data items C1, PR, GR, AM, M, T1, h and h' with reference data item DR and so determining comparison data item DC, any incorrect positioning of seat 11a along paths P1 and P2, and therefore at input and output stations 4 and 6, can be determined quickly and easily.

[0032] It should be pointed out that the particular combination of component parts of control device 13 provides for programming maintenance to correct the fault in such a way as to prolong operation of machine 1 as long as possible before the fault can pose production problems on transfer device 5.

[0033] In particular, this is achieved in a particularly advantageous manner by determining the time pattern of recording signals S, comparison data items DC and/or mean values thereof.

[0034] Computer 15 processes the signal from sensor 14' in the same way as recording signal Sa from sensor 14, to preferably obtain at least one of the following recorded data items: curve C1, peak PR, groove GR, machine angle AM, mid-line M, machine angle T1, recorded height h, recorded height h'.

[0035] In further embodiments, in addition to or instead of the above embodiments, at least one recorded data item C1, PR, GR, AM, M, T1, h and h' relative to a signal emitted by sensor 14' forms part of reference data item DR. In which case, at least one of recorded data items C1, PR, GR, AM, M, T1, h and h' relative to the signal emitted by sensor 14 is therefore compared with at least one of the corresponding recorded data items C1, PR, GR, AM, M, T1, h and h' relative to the signal emitted by sensor 14', in addition to or instead of given data items forming part of reference data item DR.

[0036] The term "given data items" is intended to mean data items relative to an ideal position of seat 11a with respect to axis 9.

[0037] In this way, a double check is made of the correct position of seat 11a : with respect to its own ideal position, and with respect to the position of seat 11'a. In this connection, it is important to stress that, for cigarettes 2 to be transferred correctly at input station 4 and output station 6, seats 11a and 11'a must be positioned correctly both with respect to each other and with respect to their ideal positions.

[0038] Figure 6 shows a further embodiment of machine 1 for processing cigarettes 2, and in which any parts similar to those in Figures 1, 2 and 3 are indicated using the same reference numbers.

[0039] Machine 1 in Figure 6 mainly differs from machine 1 in Figure 1 as regards the following.

[0040] Seats 11 and 11' are not movable axially and parallel to axis 9 with respect to one another. More specifically, seats 11' are connected integrally to conveyor roller 8; and operating unit 12 moves seats 11 radially with respect to axis 9, and rotates seats 11 about respective axes 16 substantially crosswise to axis 9.

[0041] Transfer device 5 in Figure 6 is normally used to re-orient some of cigarettes 2, so that the filters of all of cigarettes 2 are located on the same side.

[0042] In actual use, when a housing 10, comprising two seats 11 and 11', is located at input station 4, the two seats 11 and 11' are substantially coaxial with each other, and each receive a respective cigarette 2. At this point, as roller 8 rotates about axis 9 and housing 10 travels along a feed path P1, seat 11 moves radially with respect to and away from axis 9, and then rotates about axis 16 into a position parallel to respective seat 11'. At output station 6, cigarettes 2, arranged in twos with their filters side by side in seats 11 and 11', are unloaded onto conveyor wheel 7. As housing 10 returns to input station 4 along a return path P2, seat 11 repeats in reverse the same movements performed along feed path P1, so that it is once more positioned coaxially with seat 11' by the time housing 10 reaches input station 4.

[0043] Machine 1 in Figure 6 also comprises a control device 13' substantially identical, structurally and functionally, to control device 13.

[0044] Control device 13' differs from control device 13 by having only one proximity sensor 14 located along return path P2 at input station 4. Location of sensor 14 at input station 4 provides for determining, to a relatively high degree of precision, whether seat 11 is restored to a position substantially coaxial with seat 11'.

[0045] In a particularly preferred embodiment, in actual use, sensor 14 emits recording signal S as a seat 11 travels past sensor 14; signal S is processed by computer 15 to obtain curve C1; and, at this point, the machine angle of peak PR and the value of height h of peak PR are obtained and compared with reference data item DR. More specifically, the difference between the machine angle of peak PR and a reference machine angle is determined; and, when the difference between the machine angle of peak PR and the reference machine angle is above (or below) a given threshold value, control device 13' emits an error signal indicating a fault relative to incorrect rotation of seat 11 about axis 16. Similarly, computer 15 subtracts the value of height h of peak PR from a reference height value; and, when the difference between the value of height h of peak PR and the reference height value is above (or below) a given threshold value, control device 13' emits an error signal indicating a fault relative to incorrect radial movement of seat 11.

[0046] Figure 8 shows a reference curve C3 relative to a substantially fault-free device. Figure 9 shows curve C1 for various seats 11. As shown clearly by a comparison of curves C1 and C3, the height h of peak PR relative to seat 11 is considerably greater than that of the corresponding peak in curve C3. In which case, device 13' therefore emits an error signal indicating a fault relative to incorrect radial movement of seat 11.

[0047] For a clearer understanding of the operation of control device 13, Figures 10-12 show a detail of machine

1 in various operating positions. More specifically, Figure 10 shows the relative seat 11-sensor 14 position when peak PR is recorded; Figure 11 shows the relative seat 11-sensor 14 position when groove GR is recorded; and Figure 12 shows the relative seat 11-sensor 14 position when a peak PS smaller in height than peak PR is recorded.

Claims

1. A diagnostic method for operating components (12) of a machine for processing substantially cylindrical tobacco articles (2); the machine (1) comprising a transfer device (5), which feeds the articles (2) along a feed path (P1) from an input station (4) to an output station (6), and comprises a number of housings (10, 10a) oriented crosswise to the feed path and each having at least two respective elongated seats (11, 11', 11a, 11'a); during each operating cycle, each seat (11, 11', 11a, 11'a) picking up a respective article (2) at the input station (4), releasing the article (2) at the output station (6), and returning to the input station (4) along a return path (P2); the machine (1) comprising at least one operating component (12) for moving two seats (11, 11', 11a, 11'a) of a respective housing (10a) with respect to each other as the seats (11, 11', 11a, 11'a) travel along the feed path (P1) and/or the return path (P2); and the method being **characterized by** comprising a recording step, during which at least one proximity sensor (14, 14') emits a recording signal (S, Sa) relative to the position of at least one seat (11, 11', 11a, 11'a) of said housing (10a) with respect to at least one reference position; a comparing step to compare the recording signal (S, Sa) with at least one reference data item (DR) to obtain at least one comparison data item (DC); and an analysis step to determine at least one fault of the operating component (12) as a function of the comparison data item (DC).

2. A method as claimed in Claim 1, wherein the recording step is repeated a number of times to determine a number of recording signals (S, Sa) relative to the position of the seat (11, 11', 11a, 11'a); the comparing step comprising calculating a mean of the recording signals (S, Sa) and comparing the mean of the recording signals with the reference data item (DR) to obtain the comparison data item (DC).

3. A method as claimed in Claim 1 or 2, wherein the recording step is repeated a number of times to determine a number of recording signals (S, Sa) relative to the position of the seat (11, 11', 11a, 11'a); the comparing step being repeated a number of times to obtain a number of comparison data items (DC); a mean of the comparison data items (DC) being calculated during the analysis step; and the fault of the operating component (12) being determined as a function of the mean of the comparison data items (DC).

4. A method as claimed in any one of the foregoing Claims, wherein a number of comparison data items (DC) are obtained over time; a time pattern of the comparison data items (DC) or of the means of the comparison data items (DC) being determined; and the method comprising programming maintenance to correct said fault as a function of the time pattern of the comparison data items (DC) or of the means of the comparison data items (DC).

5. A method as claimed in Claim 4, wherein a test curve (K) is determined by which to extrapolate the time pattern of the comparison data items (DC) or of the means of the comparison data items (DC); and the method comprising programming maintenance as a function of the instant in which the test curve (K) intersects a first reference curve (R).

6. A method as claimed in any one of Claims 1 to 3, wherein a number of recording signals (S, Sa) are recorded over time; a time pattern of the recording signals (S, Sa) or of the means of the recording signals (S, Sa) being determined; and the method comprising programming maintenance to correct said fault as a function of the time pattern of the recording signals (S, Sa) or of the means of the recording signals.

7. A method as claimed in Claim 6, wherein a test curve (K) is determined by which to extrapolate the time pattern of the recording signals (S, Sa) or of the means of the recording signals (S, Sa); and the method comprising programming maintenance as a function of the instant in which the test curve (K) intersects a first reference curve (R).

8. A method as claimed in Claim 5 or 7, wherein the reference curve (R) is substantially constant.

9. A method as claimed in any one of the foregoing Claims, wherein, during the comparing step, the recording signal (S, Sa) is processed to obtain a response curve (C1) indicating distances between the seat (11, 11', 11a, 11'a) and the proximity sensor (14, 14') as a function of machine angles of the transfer device (5); the response curve (C1) being compared with the reference data item (DR) to obtain the comparison data item (DC).

10. A method as claimed in Claim 9, wherein the reference data item (DR) comprises a reference curve (C2; C3); the response curve (C1) being compared with the reference curve (C2; C3) to obtain the comparison data item (DC).

11. A method as claimed in Claim 9 or 10, wherein the response curve (C1) has a peak (PR) indicating the minimum distance between the seat (11, 11', 11a, 11'a) and the proximity sensor (14, 14'); a neighbourhood of the peak (PR), having a respective area (A), being determined during the comparing step; a midline (M), of the area (A) of the neighbourhood of the peak (PR), having a recorded machine angle (AM) being calculated; and the reference data item (DR) being compared with the recorded machine angle (AM) to obtain the comparison data item (DC).

12. A method as claimed in any one of Claims 9 to 11, wherein the response curve has a groove (GR) indicating the maximum distance between the seat (11, 11', 11a, 11'a) and the proximity sensor (14, 14'), and which has a recorded groove (GR) height (h'); the recorded groove (GR) height (h') being compared with the reference data item (DR) to obtain the comparison data item (DC).

13. A method as claimed in any one of Claims 9 to 12, wherein the seat (11, 11', 11a, 11'a) has an externally concave surface; the response curve (C1) being substantially W-shaped.

14. A method as claimed in any one of the foregoing Claims, wherein the recording signal has a peak (PR) indicating the minimum distance between the seat (11, 11', 11a, 11'a) and the proximity sensor (14, 14'); during the comparing step, the peak (PR) being compared with the reference data item (DR) to obtain the comparison data item (DC).

15. A method as claimed in Claim 14, wherein the peak is recorded at a minimum machine angle (T1); during the comparing step, the minimum machine angle (T1) being compared with the reference data item (DR) to obtain the comparison data item (DC).

16. A method as claimed in Claim 14 or 15, wherein the peak (PR) has a recorded peak height (h); and the recorded peak (PR) height (h) is compared with the reference data item (DR) to obtain the comparison data item (DC).

17. A method as claimed in any one of the foregoing Claims, wherein, during the comparing step, the recording signal (S, Sa) is processed to obtain a response curve (C1) indicating distances between the seat (11, 11', 11a, 11'a) and the proximity sensor (14, 14') as a function of machine angles of the transfer device (5); the response curve (C1) having different heights (h, h') for different machine angles; at least one height (h, h') of the response curve (C1) being compared with the reference data item (DR) to obtain a comparison data item (DC) relative to the distance between the seat (11, 11', 11a, 11'a) and the proximity sensor (14, 14'); and at least one machine angle of the response curve (C1) being compared with the reference data item (DR) to obtain a comparison data item (DC) indicating the position of the seat (11, 11', 11a, 11'a) along the feed and/or return path (P1, P2).

18. A method as claimed in any one of the foregoing Claims, wherein the transfer device (5) comprises a conveyor roller (8) having a respective axis (9) of rotation; the seats (11, 11', 11a, 11'a) being located on the periphery of the conveyor roller (8) and substantially parallel to the axis (9) of rotation.

19. A method as claimed in Claims 18 and 17, wherein said height (h, h') of the response curve (C1) is compared with the reference data item (DR) to obtain a comparison data item (DC) relative to a radial position of the seat (11, 11', 11a, 11'a) with respect to the axis (9) of rotation; the machine angle of the response curve (C1) being compared with the reference data item (DR) to obtain a comparison data item (DC) indicating the angular position of the seat (11, 11', 11a, 11'a) with respect to the axis (9) of rotation.

20. A method as claimed in any one of the foregoing Claims, wherein the two seats (11, 11', 11a, 11'a) of said housing (10a) are maintained substantially coaxial with each other along the feed path (P1) and the return path (P2); the operating component (12) moving the two seats (11, 11', 11a, 11'a) of the housing (10a) axially with respect to each other.

21. A method as claimed in any one of Claims 1 to 19, wherein, along the feed path (P1) and/or the return path (P2), said operating component (12) rotates and moves said seat (11, 11', 11a, 11'a) transversely.

22. A method as claimed in Claim 18 or 19, wherein, along the feed path (P1) and/or the return path (P2), said operating component (12) rotates said seat (11, 11', 11a, 11'a) about an axis (16) crosswise to the axis (9) of rotation, and moves said seat (11, 11', 11a, 11'a) substantially radially with respect to the axis (9) of rotation.

23. A method as claimed in any one of the foregoing Claims, wherein the proximity sensor (14, 14') is located along the return path (P2).

24. A method as claimed in Claim 23, wherein the proximity sensor (14, 14') is located at the input station (4).

25. A method as claimed in any one of the foregoing Claims, wherein the machine (1) comprises at least one further proximity sensor (14, 14'); during the re-

cording step, the further proximity sensor (14, 14') emitting a further recording signal (S, Sa) relative to the position of at least one further seat (11, 11', 11a, 11'a) of said housing (10a); the reference data item comprising the further recording signal (S, Sa); and, during the comparing step, the recording signal (S, Sa) being compared with the further recording signal (S, Sa) to obtain the comparison data item (DC).

26. A method as claimed in Claim 25, wherein the reference data item (DR) comprises at least one given data item; during the comparing step, the recording signal (S, Sa) being compared with the further recording signal (S, Sa) and the given data item to obtain the comparison data item (DC).

27. A diagnostic method for operating components (12) of a machine (1) for processing articles (2); the machine (1) comprising a transfer device (5), which feeds the articles (2) along a feed path (P1) from an input station (4) to an output station (6), and comprises at least one seat (11, 11', 11a, 11'a) and at least one operating component (12) for moving said seat (11, 11', 11a, 11'a); during each operating cycle, the seat (11, 11', 11a, 11'a) picking up a respective article (2) at the input station (4), releasing the article (2) at the output station (6), and returning to the input station along a return path (P2); and the method being **characterized by** comprising a recording step, during which at least one proximity sensor (14, 14') emits a recording signal (S, Sa) relative to the position of at least one seat (11, 11', 11a, 11'a) with respect to at least one reference position; a comparing step to compare the recording signal (S, Sa) with at least one reference data item (DR) to obtain at least one comparison data item (DC); and an analysis step to determine at least one fault of the operating component (12) as a function of the comparison data item (DC); during the comparing step, the recording signal (S, Sa) being processed to obtain a response curve (C1) indicating distances between the seat (11, 11', 11a, 11'a) and the proximity sensor (14, 14') as a function of machine angles of the transfer device (5); and the response curve (C1) being compared with the reference data item (DR) to obtain the comparison data item (DC).

28. A diagnostic method for operating components (12) of a machine (1) for processing articles (2); the machine (1) comprising a transfer device (5), which feeds the articles (2) along a feed path (P1) from an input station (4) to an output station (6), and comprises at least one seat (11, 11', 11a, 11'a) and at least one operating component (12) for moving said seat (11, 11', 11a, 11'a); during each operating cycle, the seat (11, 11', 11a, 11'a) picking up a respective article (2) at the input station (4), releasing the article (2) at the output station (6), and returning to the input station (4) along a return path (P2); and the method being **characterized by** comprising a recording step, during which at least one proximity sensor (14, 14') emits a recording signal (S, Sa) relative to the position of at least one seat (11, 11', 11a, 11'a) with respect to at least one reference position; a comparing step to compare the recording signal (S, Sa) with at least one reference data item (DR) to obtain at least one comparison data item (DC); and an analysis step to determine at least one fault of the operating component (12) as a function of the comparison data item (DC); during the comparing step, the recording signal (S, Sa) being processed to obtain a response curve (C1) indicating distances between the seat (11, 11', 11a, 11'a) and the proximity sensor (14, 14') as a function of machine angles of the transfer device (5); the response curve (C1) having different heights (h, h') for different machine angles; at least one height (h, h') of the response curve being compared with the reference data item (DR) to obtain the comparison data item (DC) relative to the distance between the seat (11, 11', 11a, 11'a) and the proximity sensor (14, 14'); and at least one machine angle (AM; T1) of the response curve being compared with the reference data item (DR) to obtain a comparison data item (DC) indicating the position of the seat (11, 11', 11a, 11'a) along the feed and/or return path (P1, P2).

29. A diagnostic method for operating components (12) of a machine (1) for processing tobacco articles (2); the machine (1) comprising a transfer device (5), which feeds the tobacco articles (2) along a feed path (P1) from an input station (4) to an output station (6), and comprises at least one seat (11, 11', 11a, 11'a) and at least one operating component (12, 12') for moving said seat (11, 11', 11a, 11'a); during each operating cycle, the seat (11, 11', 11a, 11'a) picking up a respective article (2) at the input station (4), releasing the article (2) at the output station (6), and returning to the input station (4) along a return path (P2); and the method being **characterized by** comprising a recording step, during which at least one proximity sensor (14, 14') emits a recording signal (S, Sa) relative to the position of at least one seat (11, 11', 11a, 11'a) with respect to at least one reference position; a comparing step to compare the recording signal (S, Sa) with at least one reference data item (DR) to obtain at least one comparison data item (DC); and an analysis step to determine at least one fault of the operating component (12) as a function of the comparison data item (DC); the machine comprising at least one further proximity sensor (14, 14'); during the recording step, the further proximity sensor (14, 14') emitting a further recording signal (S, Sa) relative to the position of at least one further seat (11, 11', 11a, 11'a); the reference data item (DR) comprising the further recording signal (S,

Sa); and, during the comparing step, the recording signal (S, Sa) being compared with the further recording signal (S, Sa) to obtain the comparison data item (DC).

30. A method as claimed in Claim 29, wherein the reference data item (DR) comprises at least one given data item; during the comparing step, the recording signal (S, Sa) being compared with the further recording signal (S, Sa) and the given data item to obtain the comparison data item (DC).

31. A machine for processing substantially cylindrical tobacco articles (2); the machine (1) comprising a transfer device (5), which feeds the articles (2) along a feed path (P1) from an input station (4) to an output station (6), and comprises a number of housings (10, 10a) oriented crosswise to the feed path (P1) and each having at least two respective elongated seats (11, 11', 11a, 11'a); during each operating cycle, each seat (11, 11', 11a, 11'a) picking up a respective article (2) at the input station (4), releasing the article (2) at the output station (6), and returning to the input station (4) along a return path (P2); the machine comprising at least one operating component (12, 12') for moving two seats (11, 11', 11a, 11'a) of a respective housing (10a) with respect to each other as the seats (11, 11', 11a, 11'a) travel along the feed path (P1) and/or the return path (P2); and the machine (1) being **characterized by** comprising a control device (13), in turn comprising at least one proximity sensor (14, 14') which emits a recording signal (S, Sa) relative to the position of at least one seat (11, 11', 11a, 11'a) of the housing (10a) with respect to at least one reference position, and a computer (15) which compares the recording signal (S, Sa) with at least one reference data item (DR) to obtain at least one comparison data item (DC) and determine at least one fault of the operating component (12) as a function of the comparison data item (DC) .

32. A machine as claimed in Claim 31, wherein the control device (13) implements a method as claimed in one of Claims 2 to 26.

33. A machine for processing articles (2); the machine (1) comprising a transfer device (5), which feeds the articles (2) along a feed path (P1) from an input station (4) to an output station (6), and comprises at least one seat (11, 11', 11a, 11'a) and at least one operating component (12, 12') for moving said seat; during each operating cycle, the seat (11, 11', 11a, 11'a) picking up a respective article (2) at the input station (4), releasing the article (2) at the output station (6), and returning to the input station (4) along a return path (P2); and the machine (1) being **characterized by** comprising a control device (13), in turn comprising a proximity sensor (14, 14') which emits a recording signal (S, Sa) relative to the position of at least one seat (11, 11', 11a, 11'a) of a housing (10a) with respect to at least one reference position, and a computer (15) for comparing the recording signal (S, Sa) with at least one reference data item (DR) to obtain at least one comparison data item (DC), and for determining at least one fault of the operating component (12) as a function of the comparison data item (DC); the control device (13) comprising at least one further proximity sensor (14, 14'); the further proximity sensor (14, 14') emitting a further recording signal (S, Sa) relative to the position of at least one further seat (11, 11', 11a, 11'a); the reference data item comprising the further recording signal (S, Sa); and the computer comparing the recording signal (S, Sa) with the further recording signal (S, Sa) to obtain the comparison data item (DC).

34. A machine as claimed in Claim 33, wherein the reference data item (DR) comprises at least one given data item; the computer (15) comparing the recording signal (S, Sa) with the further recording signal (S, Sa) and the given data item to obtain the comparison data item (DC).

35. A machine for processing articles (2); the machine (1) comprising a transfer device (5), which feeds the articles (2) along a feed path (P1) from an input station (4) to an output station (6), and comprises at least one seat (11, 11', 11a, 11'a) and at least one operating component (12) for moving said seat (11, 11', 11a, 11'a); during each operating cycle, the seat (11, 11', 11a, 11'a) picking up a respective article (2) at the input station (4), releasing the article (2) at the output station (6), and returning to the input station (4) along a return path (P2); and the machine (1) being **characterized by** comprising a control device (13), in turn comprising a proximity sensor (14, 14') which emits a recording signal (S, Sa) relative to the position of at least one seat (11, 11', 11a, 11'a) with respect to at least one reference position, and a computer (15) for comparing the recording signal (S, Sa) with at least one reference data item (DR) to obtain at least one comparison data item (DC), and for determining at least one fault of the operating component (12) as a function of the comparison data item (DC); the computer (15) processing the recording signal (S, Sa) to obtain a response curve (C1) indicating distances between the seat (11, 11', 11a, 11'a) and the proximity sensor (14, 14') as a function of machine angles of the transfer device (5); and the response curve (C1) being compared with the reference data item (DR) to obtain the comparison data item (DC).

36. A machine for processing articles, the machine (1) comprising a transfer device (5), which feeds the articles (2) along a feed path (P1) from an input station

(4) to an output station (6), and comprises at least one seat (11, 11', 11a, 11'a) and at least one operating component (12) for moving said seat (11, 11', 11a, 11'a); during each operating cycle, the seat (11, 11', 11a, 11'a) picking up a respective article (2) at the input station (4), releasing the article (2) at the output station (6), and returning to the input station (4) along a return path (P2); and the machine (1) being **characterized by** comprising a control device (13), in turn comprising a proximity sensor (14, 14') which emits a recording signal (S, Sa) relative to the position of at least one seat (11, 11', 11a, 11'a) with respect to at least one reference position, and a computer (15) for comparing the recording signal (S, Sa) with at least one reference data item (DR) to obtain at least one comparison data item (DC), and for determining at least one fault of the operating component (12) as a function of the comparison data item (DC); the computer (15) processing the recording signal (S, Sa) to obtain a response curve (C1) indicating distances between the seat (11, 11', 11a, 11'a) and the proximity sensor (14, 14') as a function of machine angles of the transfer device (5); the response curve (C1) having different heights (h, h') for different machine angles; the computer (15) comparing at least one height (h, h') of the response curve (C1) with the reference data item (DR) to obtain a comparison data item (DC) relative to the distance between the seat (S, Sa) and the proximity sensor (14, 14'); and the computer (15) comparing at least one machine angle (AM; T1) of the response curve with the reference data item to obtain a comparison data item (DC) indicating the position of the seat (11, 11', 11a, 11'a) along the feed and/or return path (P1, P2).

37. A diagnostic method for operating components (12) of a machine (1) for processing articles (2); the machine (1) comprising a transfer device (5), which feeds the articles (2) along a feed path (P1) from an input station (4) to an output station (6), and comprises at least one seat (11, 11', 11a, 11'a) and at least one operating component (12) for moving said seat (11, 11', 11a, 11'a); during each operating cycle, the seat (11, 11', 11a, 11'a) picking up a respective article (2) at the input station (4), releasing the article (2) at the output station (6), and returning to the input station (4) along a return path (P2); and the method being **characterized by** comprising a recording step, during which at least one proximity sensor (14, 14') emits a recording signal (S, Sa) relative to the position of at least one seat (11, 11', 11a, 11'a) with respect to at least one reference position; a comparing step to compare the recording signal (S, Sa) with at least one reference data item (DR) to obtain at least one comparison data item (DC); and an analysis step to determine at least one fault of the operating component (12) as a function of the comparison data item (DC); the recording signal (S, Sa) having a peak (PR) indicating the minimum distance between the seat (11, 11', 11a, 11'a) and the proximity sensor (14, 14'); and, during the comparing step, the peak (PR) being compared with the reference data item (DR) to obtain the comparison data item (DC).

38. A control device (13) for producing a machine as claimed in one of Claims 31 to 36.

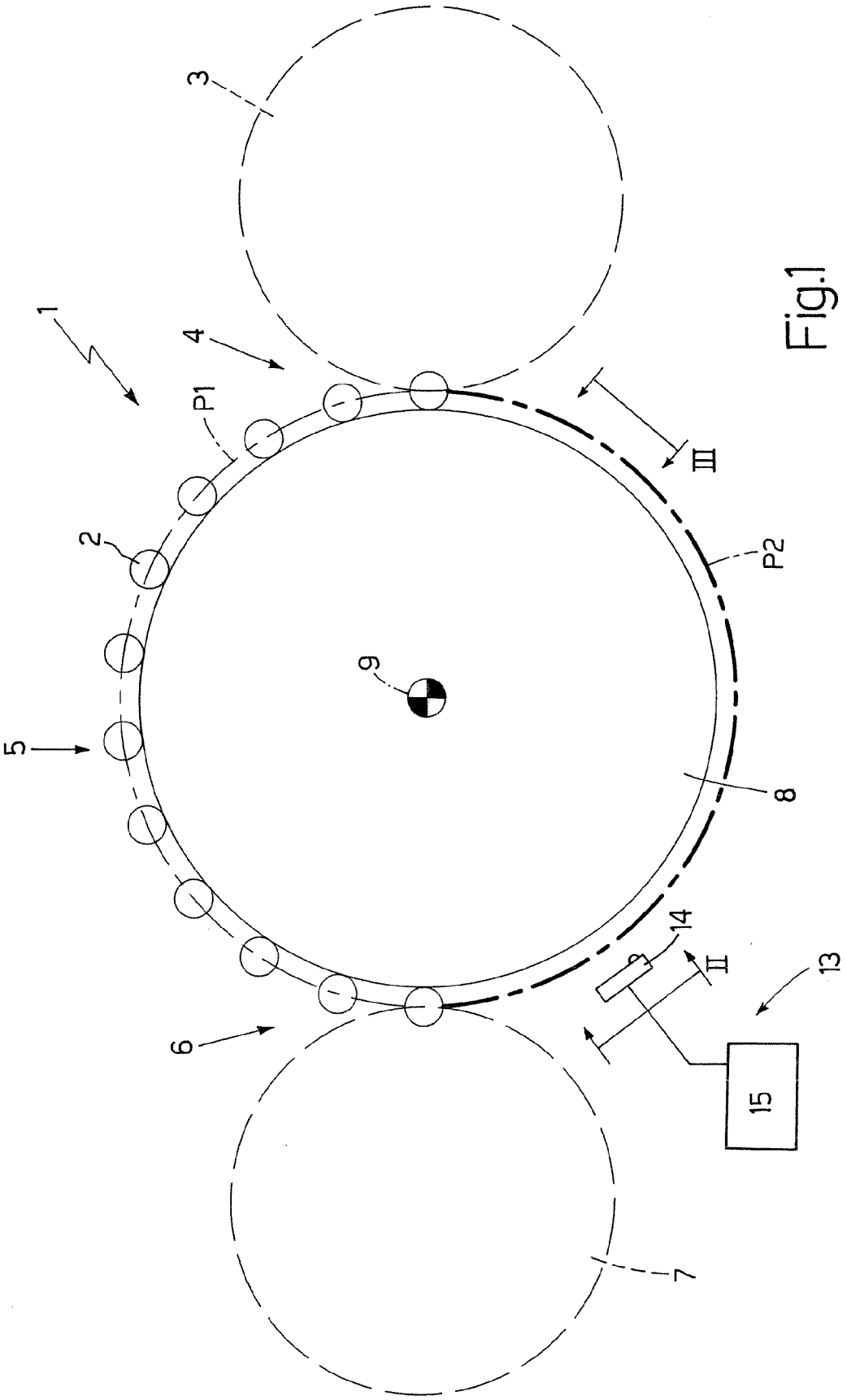

Fig.1

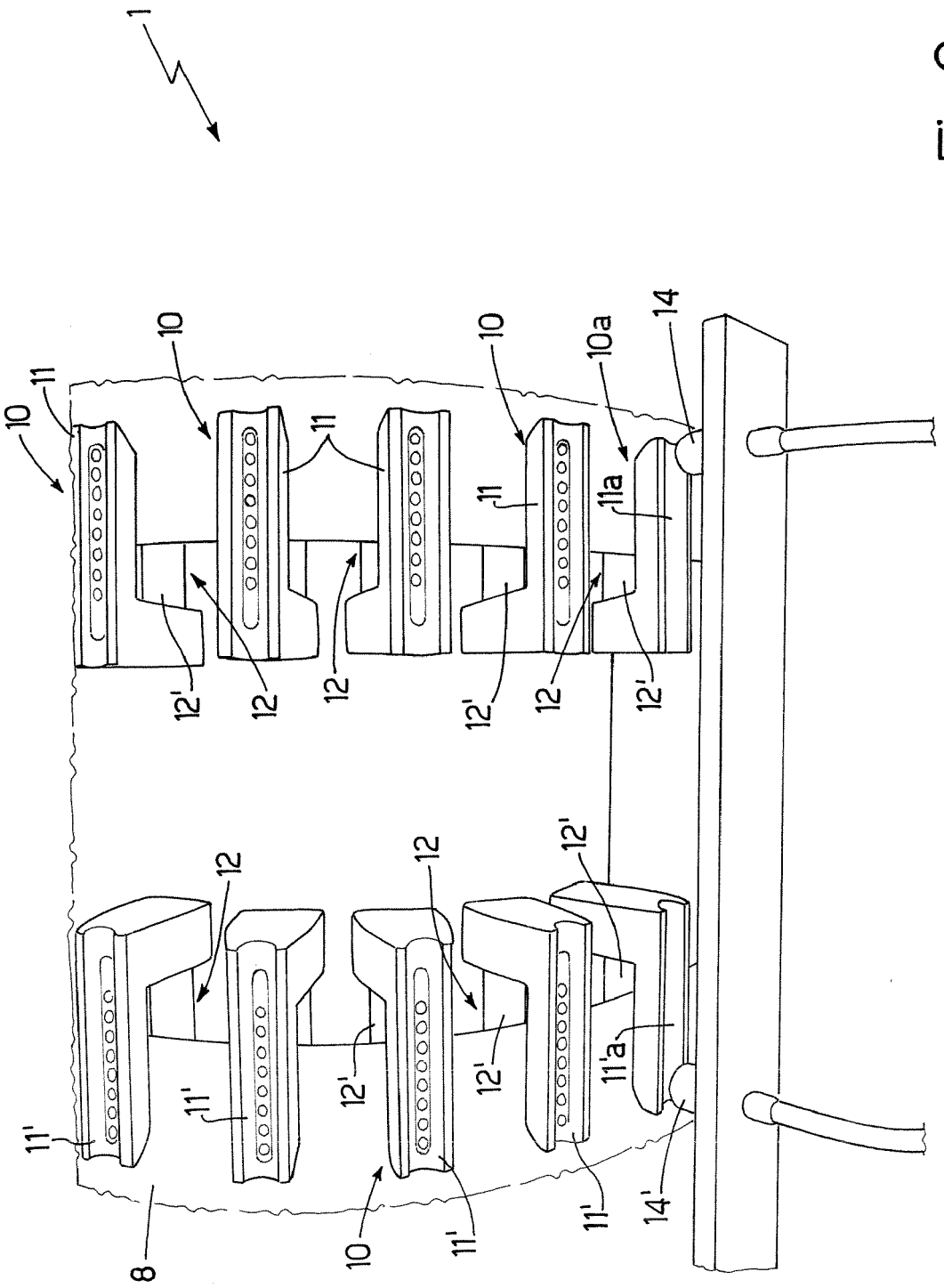
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Fig.2

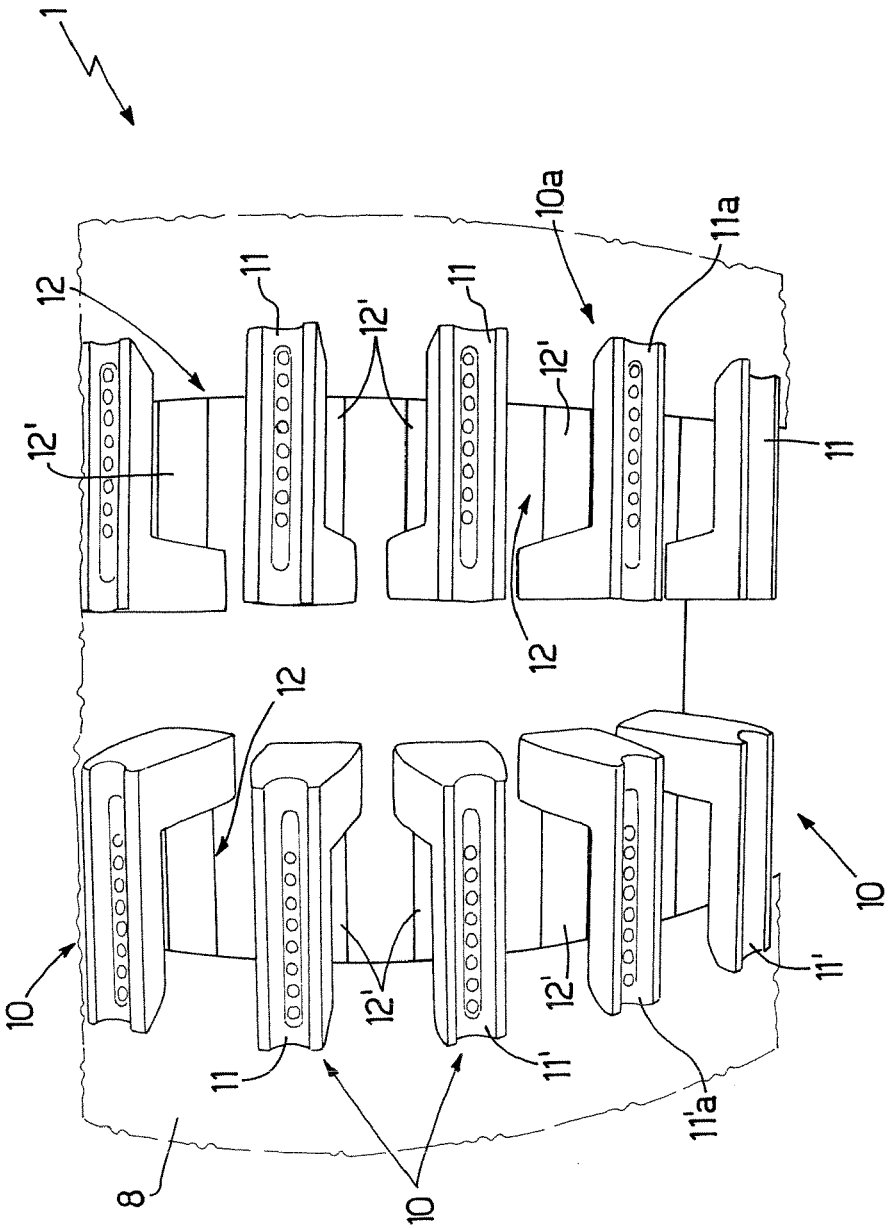


Fig.3

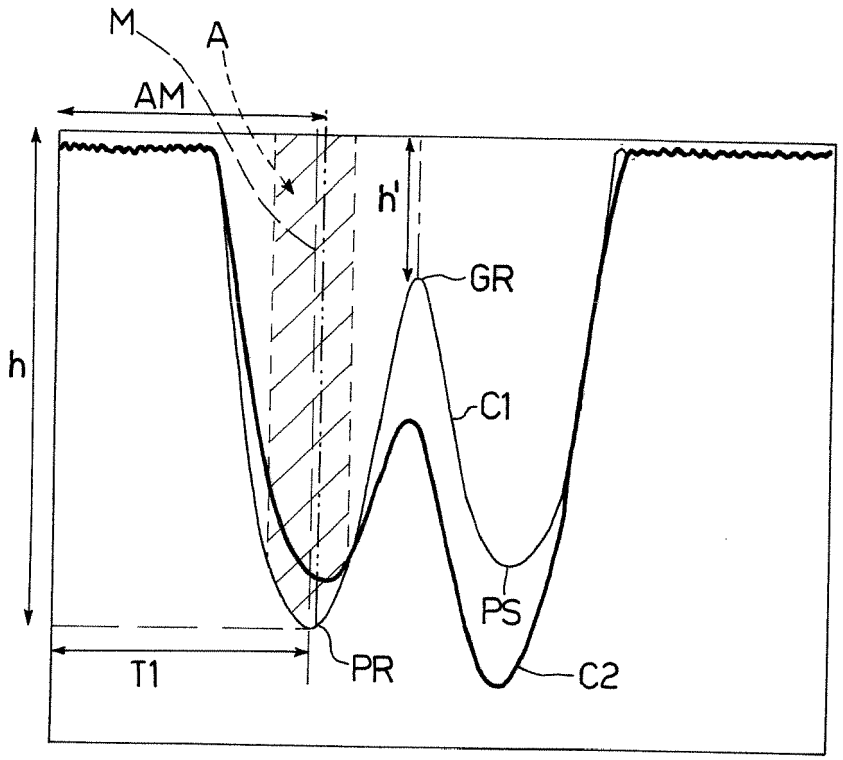


Fig.4

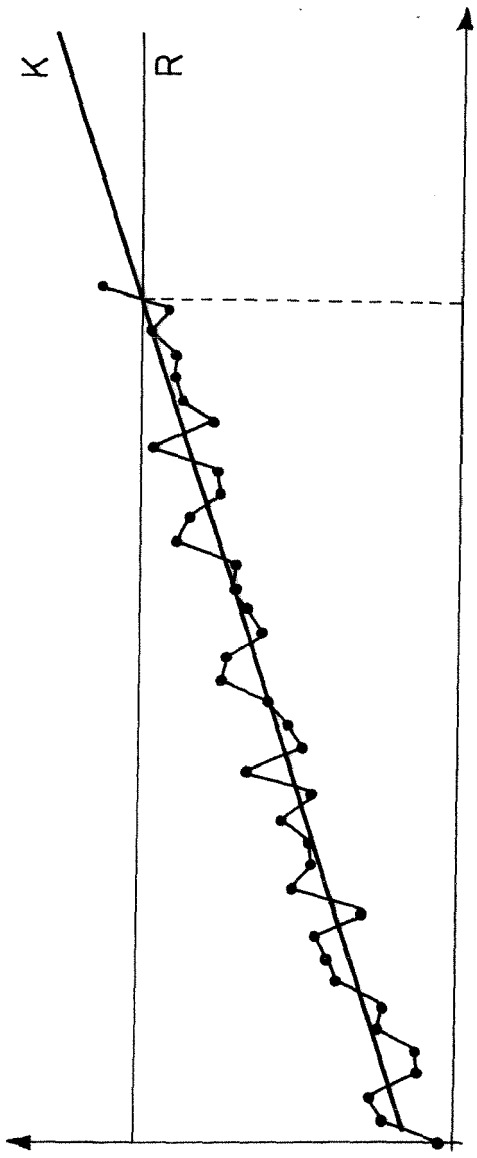


Fig.5

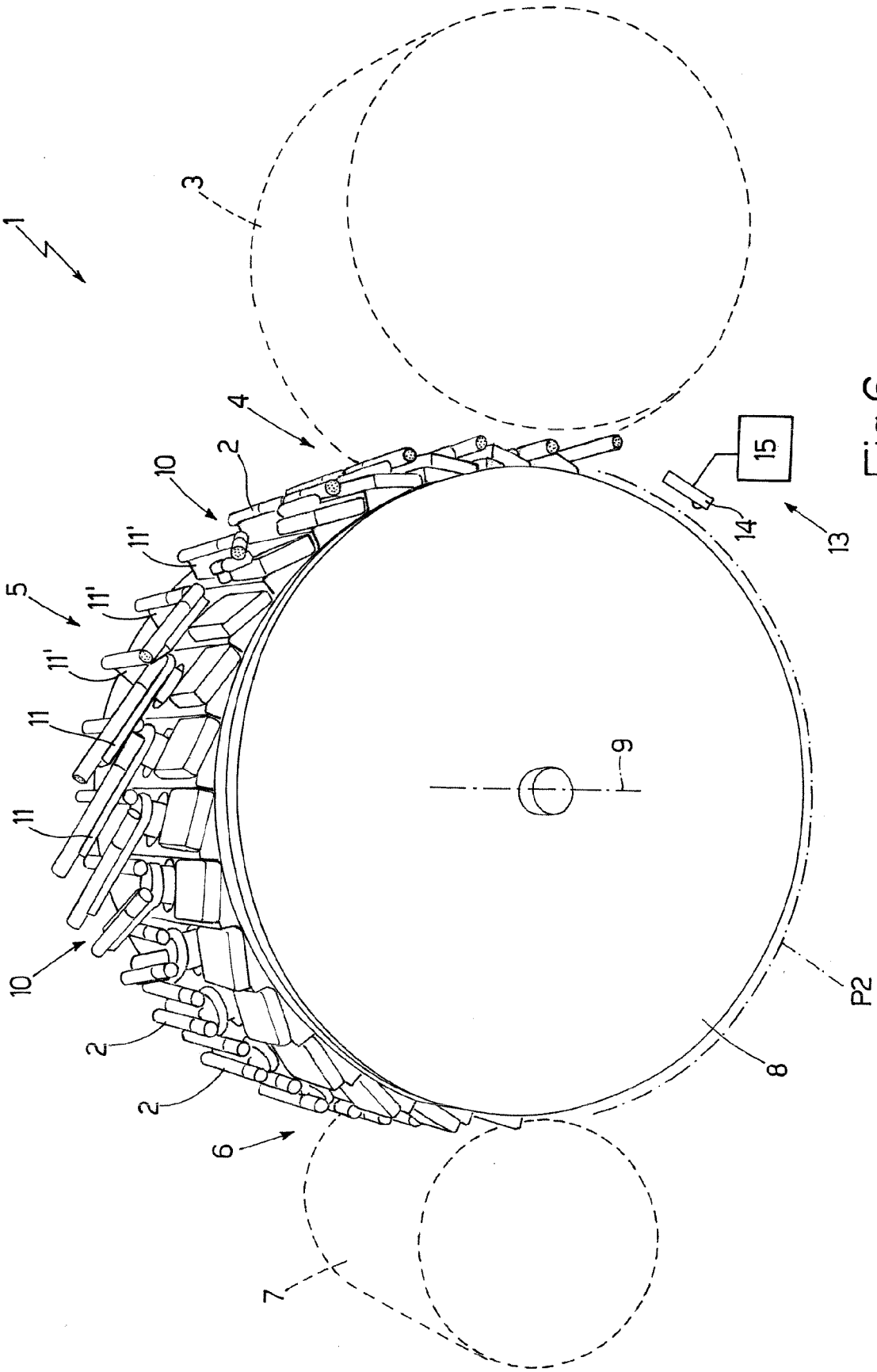
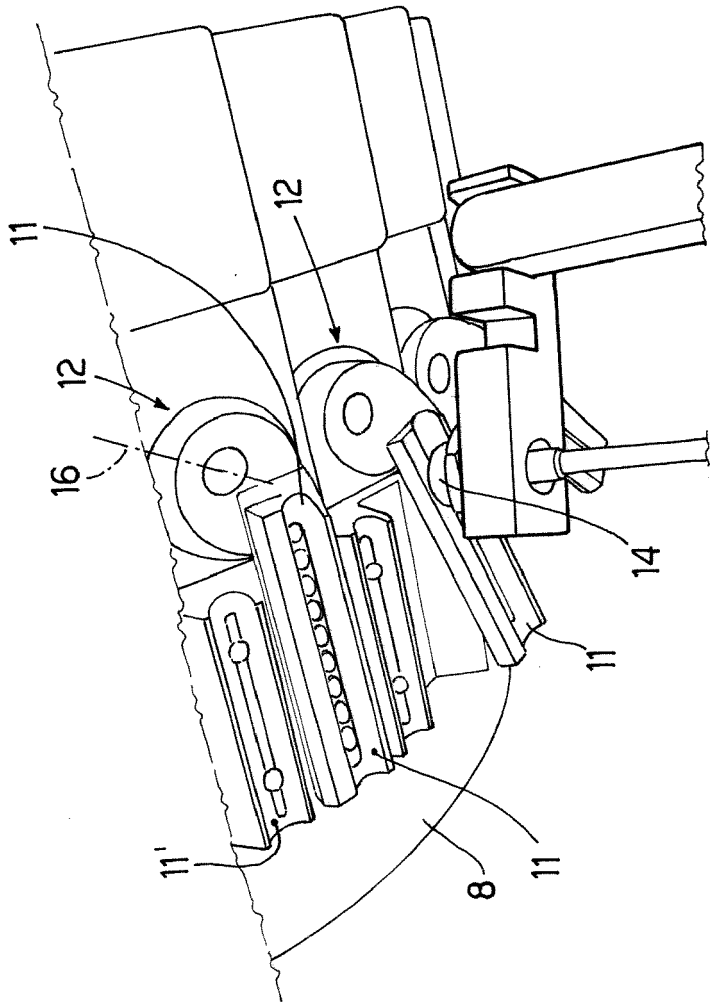


Fig.6

Fig.7



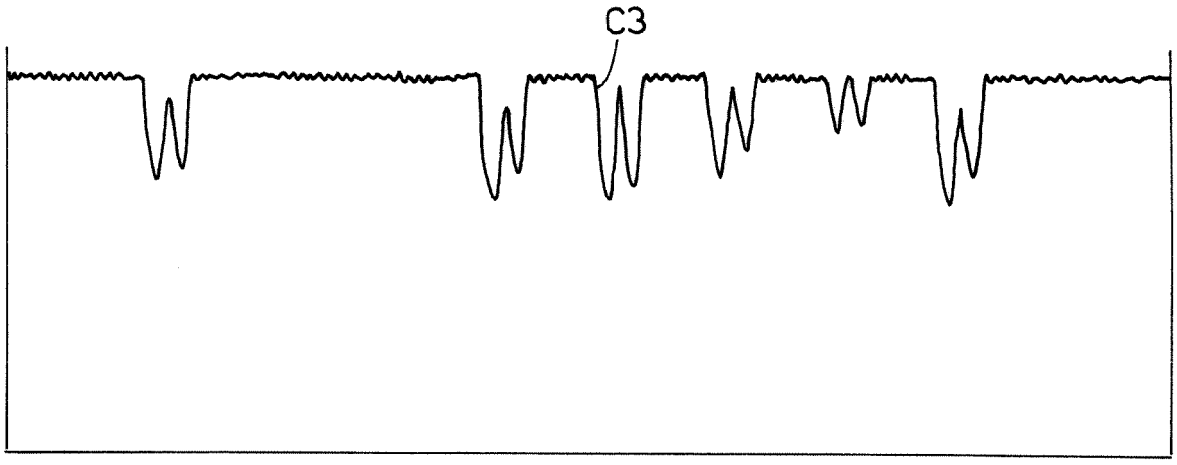


Fig.8

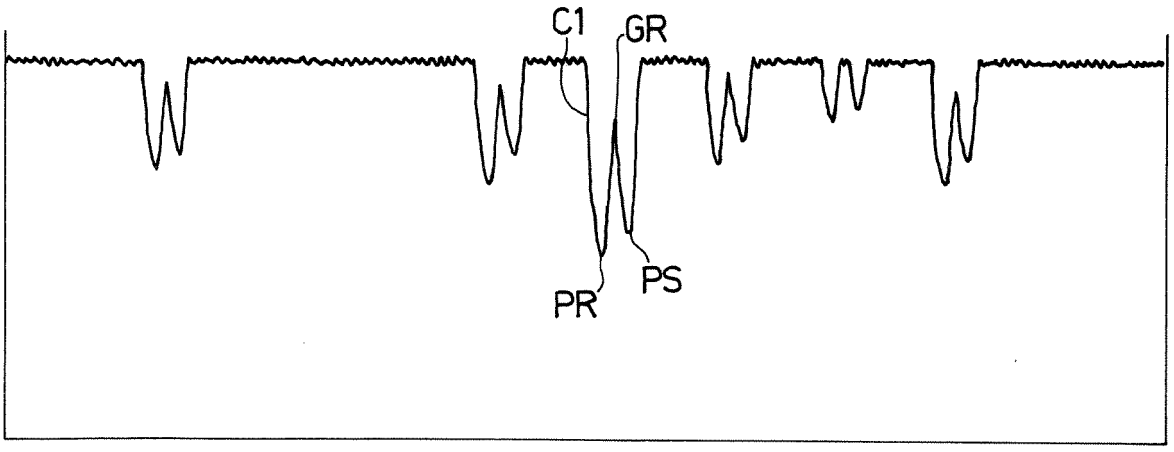


Fig.9

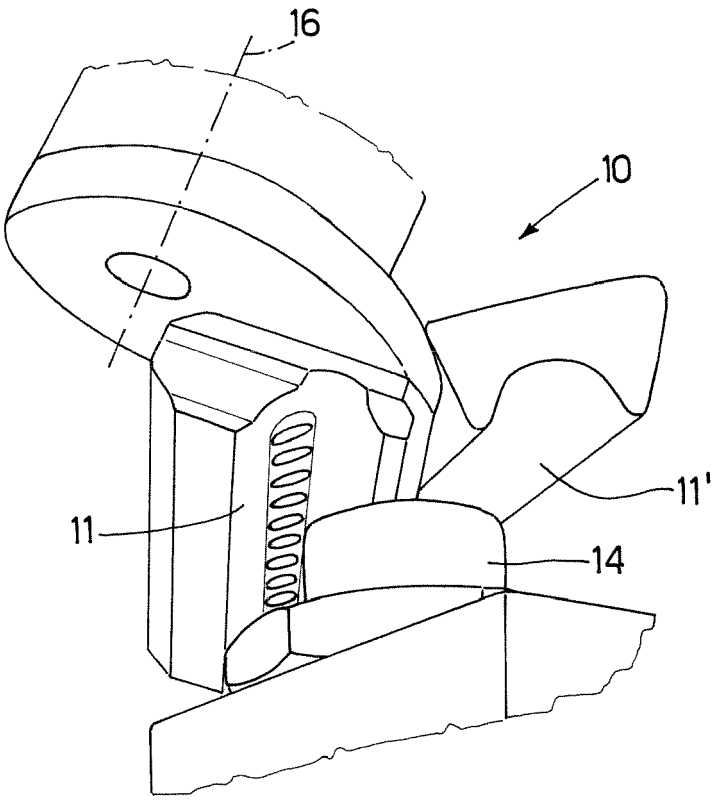


Fig.10

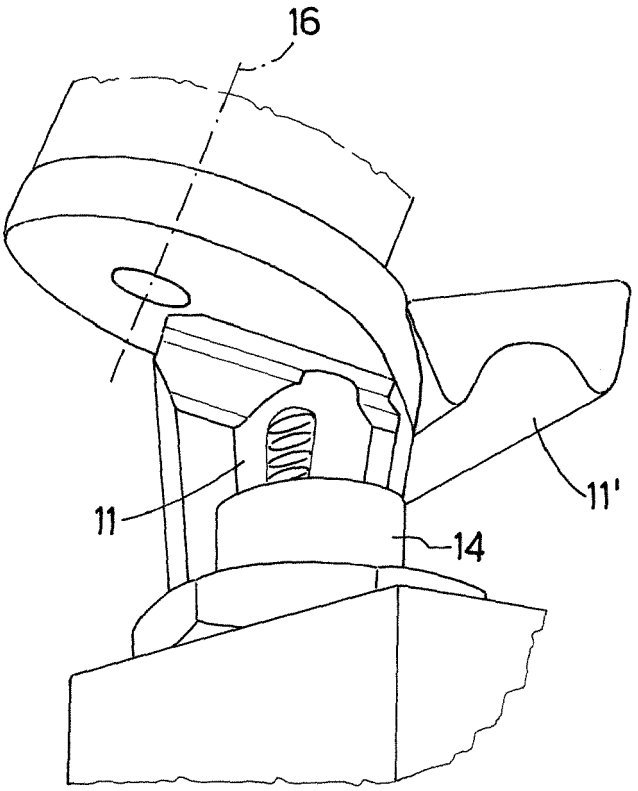


Fig.11

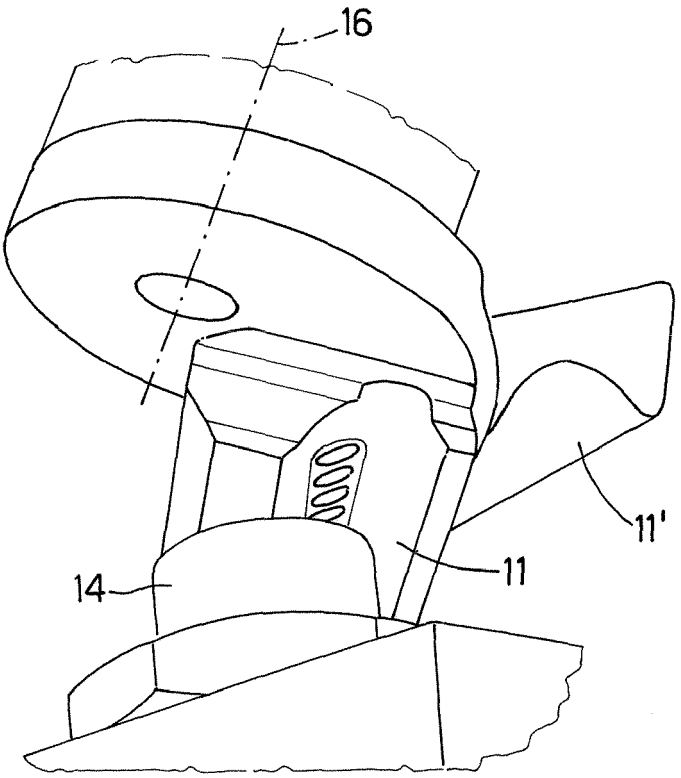


Fig.12

European Patent Office

PARTIAL EUROPEAN SEARCH REPORT

which under Rule 45 of the European Patent Convention shall be considered, for the purposes of subsequent proceedings, as the European search report

Application Number EP 06 11 1787

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 2004/108186 A1 (RINKE ANDREAS ET AL) 10 June 2004 (2004-06-10) * paragraph [0021] - paragraph [0036]; figures 1-6 *	1,31	INV. A24C5/32
A	DE 32 32 792 A1 (HAUNI-WERKE KOERBER & CO KG; KOERBER AG, 2050 HAMBURG, DE) 31 March 1983 (1983-03-31) * page 10, paragraph 4 - page 11, paragraph 1; claim 10 * * page 18; figures 1,2 *	1,31	
A	US 5 209 249 A (NERI ET AL) 11 May 1993 (1993-05-11) * column 1, line 5 - line 68 * * column 2, line 31 - column 8, line 23; figures 1-8 *	1,31	
P,A	US 2005/139452 A1 (FOLGER MANFRED ET AL) 30 June 2005 (2005-06-30) * paragraph [0023] - paragraph [0029]; figures 1,2 *	1,31	

TECHNICAL FIELDS SEARCHED (IPC)

A24C

INCOMPLETE SEARCH

The Search Division considers that the present application, or one or more of its claims, does/do not comply with the EPC to such an extent that a meaningful search into the state of the art cannot be carried out, or can only be carried out partially, for these claims.

Claims searched completely :

Claims searched incompletely :

Claims not searched :

Reason for the limitation of the search:

see sheet C

Place of search	Date of completion of the search	Examiner
Munich	24 July 2006	Maier, M

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C07)

European Patent Office

INCOMPLETE SEARCH SHEET C

Application Number
EP 06 11 1787

Claim(s) searched completely:
1-26, 31

Claim(s) not searched:
27-30, 32-38

Reason for the limitation of the search:

The present application contains 38 claims, of which 10, namely claims 1, 27, 28, 29, 31, 33, 35, 36, 37 and 38 are independent. There is no clear distinction between the independent claims because of overlapping scope. There are so many claims, and they are drafted in such a way that the claims as a whole are not in compliance with the provisions of clarity and conciseness of Article 84 EPC, as it is particularly burdensome for a skilled person to establish the subject-matter for which protection is sought. The non-compliance with the substantive provisions is to such an extent, that a meaningful search of the whole claimed subject-matter could not be carried out (Rule 45 EPC and Guidelines B-VIII, 3). The extent of the search was consequently limited.

The search was based on the subject-matter that, as far as can be understood, could reasonably be expected to be claimed later in the procedure, and the corresponding claims, namely independent claims 1 and 31. All other claims would expand the scope of the search to virtually all machines processing any kind of articles, and diagnostic methods therefor, while the preferred embodiments disclosed are limited to machines for processing cylindrical tobacco articles, and a diagnostic method therefor.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 06 11 1787

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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24-07-2006

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EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82