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(71) Applicant: **G.D S.p.A.**
40133 Bologna (IT)

(72) Inventors:

- **ZANNI, Paolo**
40133 BOLOGNA (IT)
- **VILLA, Stefano**
40133 BOLOGNA (IT)
- **DEGLI ESPOSTI, Matteo**
40133 BOLOGNA (IT)
- **ZACCHI, Lorenzo**
40133 BOLOGNA (IT)

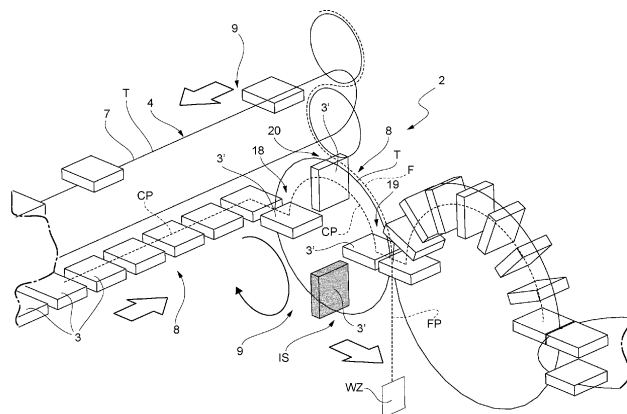
(74) Representative: **Studio Torta S.p.A.**
Viale Antonio Silvani, 6
40122 Bologna (IT)

(54) **PROCESS FOR THE MANAGEMENT OF WASTE WITH SEMIFINISHED PRODUCT
RECIRCULATION FOR AN AUTOMATIC MACHINE FOR MANUFACTURING OR PACKING
CONSUMER ARTICLES**

(57) Process for the management of waste with re-circulation of semifinished articles (3) of at least part (2) of an automatic machine (1) for manufacturing or packing consumer articles; the process comprises the steps of: conveying, by means of a circuitual conveyor system (4) and according to a first periodic law of motion, a plurality of semifinished articles (3) along a conveying path (CP); wherein the circuitual conveyor system (4) comprises a normally operating portion (8) and a normally non-operating portion (9); checking, in a control area (IA), the quality and/or the position and/or the orientation of an article

(3') being processed and/or of a component (11, 11") to be added to the article (3') being processed; and, in case the article (3') being processed and/or of a component (11, 11") are defective, a recirculation step, during which the article (3') being processed continues to be conveyed according to the first periodic law of motion through the normally non-operating portion (9) and the at least one inactive station (IS), recirculating by means of the circuitual conveyor system (4) until returning to the normally operating portion (8).

FIG. 2



Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This patent application claims priority from Italian patent application no. 102022000022389 filed on October 31, 2022, the entire disclosure of which is incorporated herein by reference.

TECHNICAL FIELD

[0002] The present invention relates to a process for the management of waste with semifinished product recirculation for an automatic machine for manufacturing or packing consumer articles.

[0003] The present invention finds advantageous but not exclusive application in the management of waste with semifinished product recirculation for an automatic packaging machine that manufactures packets of cigarettes, to which the following disclosure will make explicit reference without thereby losing generality.

PRIOR ART

[0004] An automatic packaging machine for cigarettes usually comprises a plurality of actuators acting on the articles to modify the conformation, structure, or position thereof and each actuator can take a plurality of different positions.

[0005] Generally, some actuators are used to convey semifinished articles through a plurality of processing stations. Said conveyor systems, in most cases, are continuous systems, namely, systems that move at a constant speed or according to periodic laws of motion in order to respect pre-established coincidences between the article, the components to be added to the article to complete the same and the processing to be carried out.

[0006] The processing stations, in turn, comprise other actuators aimed at feeding the aforementioned components to be added to the semifinished articles (for example an inner wrap, a collar, a blank, an absorbent layer, etc.) and/or processing the articles.

[0007] Lately, the environmental problem relating to industrial waste has become increasingly widespread. Furthermore, said problem is in the interests of the manufacturer, as the reduction of waste generates (unless there is an excessively long machine downtime) considerable savings in raw materials, namely in the components to be processed and combined to form a consumer article.

[0008] However, usually, even if the control of the components fed to an article takes place before the components are used, it is difficult to reject only the defective components.

[0009] In particular, based on a negative control result (namely, a component resulting defective by a control system, for example a sensor), two scenarios generally occur. In the event that the component is so defective

that it cannot support the following production process for structural reasons (for example, it is torn, too wet, etc.) or due to possible jamming (for example, it is in the wrong position, incorrect orientation, etc.), the automatic machine stops its production and an operator must reject the defective product manually in order to restart the production. If, however, the defective component is able to support the following production process (for example a band or inner wrap or a collar has creases or stains or slight misalignments, but without being structurally compromised), the production continues and the packet comprising the defective component is rejected entirely at the end of the production process, as the same is marked as unsuitable in its entirety due to the single defective component not conforming to the required specifications.

[0010] This policy in the management of waste from a high-productivity automatic machine determines a double disadvantage, since, in the first case, production is stopped entirely and, in the second case, an entire packet is rejected, comprising, in addition to the defective component, also a plurality of nondefective usable components (for example a group of good quality cigarettes).

[0011] Furthermore, the higher the productivity of the machine, the greater the disadvantages. In the first case (structurally compromised component), in which the automatic machine is stopped by an alarm, greater productivity determines, for the same amount of time spent resetting the alarm, a greater loss of production. In the second case, higher productivity having a consistent reject rate results in a greater quantity of entirely rejected packets due to a single defective component.

DESCRIPTION OF THE INVENTION

[0012] The object of the present invention is to provide a process for the management of waste with semifinished product recirculation for an automatic machine for manufacturing or packing consumer articles which is at least partially free from the drawbacks described above and, at the same time, is simple and inexpensive to implement.

[0013] According to the present invention, a process is provided for the management of waste with semifinished product recirculation for an automatic machine for manufacturing or packing consumer articles as claimed in the attached claims. An automatic machine for manufacturing or packing consumer articles configured to carry out the aforementioned process is also provided.

[0014] The claims describe preferred embodiments of the present invention forming an integral part of the present description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The present invention will now be described with reference to the attached drawings, which illustrate some non-limiting embodiments thereof, wherein:

- Figure 1 is a perspective and schematic view, with

details removed for clarity, of an automatic machine for the production of articles for the tobacco industry;

- Figure 2 is a perspective and schematic view of a detail of the automatic machine of Figure 1 in an alternative in which two types of recirculation are shown;
- Figure 3 is a perspective and schematic view of part of the automatic machine of Figure 1 in a first step;
- Figures 4 is a front and schematic view of the part of the automatic machine of Figure 2 in the first step;
- Figure 5 is a front and schematic view of the part of the automatic machine of Figure 2 in a second step; and
- Figure 6 is a front and schematic view of the part of the automatic machine of Figure 2 in a third step.

PREFERRED EMBODIMENTS OF THE INVENTION

[0016] In Figure 1, number 1 denotes, as a whole, an automatic machine for the production of articles 3 for the tobacco industry, in particular an automatic packaging machine 1 for applying an inner wrap to a group of cigarettes, or for applying a transparent over wrap to packets of cigarettes.

[0017] The same reference numbers and letters in the figures identify the same elements or components with the same function.

[0018] In the context of the present disclosure the term "second" component does not imply the presence of a "first" component. Said terms are in fact used as labels to improve clarity and should not be interpreted in a restrictive way.

[0019] The elements and characteristics illustrated in the different preferred embodiments, comprising the drawings, can be combined with one another without departing from the scope of the present application as described in the following.

[0020] The automatic machine 1 comprises various parts provided, in turn, with one or more work stations WS configured to carry out processing on semifinished articles 3 (for example the groups of cigarettes schematized as packets in the embodiment illustrated in Figures 1 and 2).

[0021] In particular, the automatic machine 1 comprises a part 2 provided with a circuital conveyor system 4, which is configured to convey the semifinished articles 3 singularly or in groups (for example in groups of two, as illustrated in Figures 3 to 6) along a conveying path CP and according to a first periodic law of motion. In detail, the first periodic law of motion determines the conveying of the semifinished articles 3 along the conveying path CP in an intermittent manner, with a constant period.

[0022] More specifically, the circuital conveyor system 4 is a device capable of moving the semifinished articles 3 along a circuit T defining a closed, preferably curved line.

[0023] In some preferred non-limiting cases, the circuital conveyor system 4 is a drum 5, provided, in par-

ticular on its circumferential portion, with seats 6 (in particular pockets) suitable for receiving the semifinished articles 3 (for example the groups of cigarettes held together by a collar). In these cases, the circuit T turns out to be a circle. The drum 5 is mounted to rotate around a central rotation axis illustrated in Figure 5.

[0024] In other non-limiting cases, the circuital conveyor system 4 is a belt 7, also provided, in particular on its outer portion, with seats 6 to house the semifinished articles 3. In these cases, the circuit T is formed by two straight sections and two semicircles.

[0025] In the non-limiting embodiment of Figures 1 and 2, the part 2 of the machine 1 comprises two different circuital conveyor systems 4', 4'', one of which 4' is provided with a drum 6 and the other 4'' with a belt 7.

[0026] In the non-limiting embodiments of the attached figures, the circuital conveyor system 4 comprises a normally operating portion 8, in turn comprising one or more work stations WS, and a normally non-operating portion 9, devoid of work stations WS, in detail comprising, in turn, at least one inactive station IS. In other words, the normally operating portion 8 is that part of the circuital conveyor system 4 in which the articles are processed and/or moved during the correct production of the machine, which does not foresee that any article 3 ends up in the normally non-operating portion 9.

[0027] In particular, the inactive station IS is an area of the normally non-operating portion 9 in which the circuital conveyor system 4 causes the semifinished articles 3 to stand (namely, remain standing still in position) temporarily (namely, for a length of limited and predefined time) and sequentially the semifinished articles 3 that pass through the normally non-operating portion 9. In other words, the inactive station IS is an area of the normally non-operating portion 9 in which the circuital conveyor system 4 temporarily places those articles 3 that do not receive correct processing from the work station WS, thus allowing the same to be recirculated and reused in a following processing cycle.

[0028] In particular, the normally operating portion 8 and the normally non-operating portion 9 are contiguous and consecutive to one another on the circuital conveyor system 4. In other words, the normally operating portion 8 and the normally non-operating portion 9 together comprise the entire circuit T.

[0029] In the non-limiting embodiments of the attached figures, a component 11 is applied in the work station WS, in this case a wrap, for example an inner wrap of a packet of cigarettes or a transparent overwrap. Obviously, the component 11 can be any type of element to be added to the article 3, such as for example a collar, a glue, a support, a fastening element, a label, a blank, an absorbent sheet, an elastic, a food product, etc. In the following description, in a non-limiting manner, number 3 will denote the consumer articles in general and the expression 3' will denote the consumer article being processed. Furthermore, number 11 will denote the components in general, the expression 11' will denote the de-

fective components and the expression 11" will denote the new components, following defective components 11'.

[0030] In particular, as illustrated in the non-limiting embodiment of Figure 5, during the exit of the semifinished articles 3 from the seats 6, the article 3' being processed (namely, the one within the work station WS, namely, the one in output) passes towards the component 11 and pushes the latter towards a further seat of the following transport system following the conveyor system 4 so as to be wrapped.

[0031] In some non-limiting cases such as that illustrated in the attached figures, the component 11 is a flat element, in particular a band, a wrap or a blank.

[0032] According to some preferred but not limiting embodiments, the actuators that move the conveying device 4 (and/or the pushing elements) and/or the feeding system 16 comprise electric motors (in particular of the *brushless* type) independent of one another. According to further and not illustrated embodiments, the actuators also comprise driver types other than electric motors (for example pneumatic or hydraulic cylinders, electrically actuated cylinders, etc.).

[0033] Advantageously but not restrictively, the automatic machine 1 comprises at least a store 12 containing one or more components 11.

[0034] In some non-limiting cases, the component 11 is obtained from a seamless band, which is fed, cut, and possibly rejected along a feeding path FP. In other words, the component 11 is a continuous band of wrapping material and therefore the store 12 is a reel. In other non-limiting and non-illustrated embodiments, the store 12 comprises a plurality of components separated (for example collars or blanks) and stored (for example in stacks).

[0035] Furthermore, as illustrated in the non-limiting embodiments of Figures from 3 to 6, the automatic machine 1 comprises a control system 10, which is configured to detect the quality and/or the position and/or the orientation of an article 3' being processed and/or of a component 11, 11" to be added to the article 3' being processed in order to establish whether the component 11 is usable or defective.

[0036] In particular, the control system 10 configured to detect, during the feeding of the components 11, the quality and/or the position and/or the orientation of at least one component 11 so as to establish whether the component is usable or defective. For example, a component 11 could be considered defective if it has wrinkles, folds, holes, tears, stains, inconsistent thickness, unsuitable humidity, incorrect position, incorrect inclination, etc. On the contrary, a component 11 is to be considered suitable if it complies with all the minimum quality and/or the orientation and/or the position specifications.

[0037] In some non-limiting and not illustrated cases, the control system 10 is a photo camera, which, for each component 11 that passes in front of the same, carries out a scan (namely, a photo) to determine the quality,

orientation, and position thereof and define whether it is defective or suitable. Advantageously but not necessarily, the photo camera is comprised in a viewing and image processing system (in turn comprised in the control system 10) of a type known and not further illustrated.

[0038] In other non-limiting embodiments, the control system 10 is any type of sensor capable of establishing the quality and/or the position and/or the orientation of a product (e.g., ultrasonic sensors, capacitive sensors, microwave sensors, photodetectors 14 as illustrated in the embodiments of Figures from 3 to 6, etc.).

[0039] The automatic machine 1 comprises, furthermore, a control unit 13 (illustrated schematically in Figure 1) configured to control at least the conveyor system 4, 4' (by means of an actuator 15). For example, the control unit 13 is the processor of an industrial control unit or an industrial PC.

[0040] Advantageously, the control unit 13 is configured to control, in case the fed component 11' and/or the article being processed 3' is defective, the circuital conveyor system 4 to recirculate the article 3' being processed, which continues to be conveyed according to the first periodic law of motion through the normally non-operating portion 9 (and the at least one inactive station IS), recirculating, by means of the circuital conveyor system 4 up to the normally operating portion 8, in particular to the work station WS, to be processed, for example to couple with a new component 11".

[0041] According to some preferred but not limiting embodiments, the machine 1 further comprises a feeding system 16 configured to feed at least one component 11 from the respective store 12 towards the conveying path CP through at least the work station WS, where the component 11, 11" is added (and coupled) to the article 3' being processed and along the feeding path FP. In particular, the components 11 are also conveyed according to a second periodic law of motion, which preferably has the same period as the first periodic law of motion. In this way, the articles 3 and the components 11 can move simultaneously along the conveying path CP.

[0042] In particular, but not restrictively, the part 2 of the machine 1 comprises, furthermore, a waste zone WZ configured to receive any defective components 11'.

[0043] Preferably, the control unit 13 is configured to also control the feeding system 16 (by means of an actuator 17).

[0044] Advantageously but not necessarily, the control unit 13 also controls the drum 5 and, in particular, all the actuators of the part 2 of the automatic machine 1.

[0045] Advantageously but not restrictively, the control unit 13 is configured to control, in case the fed component 11' is defective, the feeding system 16 to replace the defective component 11', and to convey the defective component 11' from the control area IA towards the waste zone WZ and replace the same, within the work station WS, with a new component 11", which is fed from the store 12 towards the conveying path CP and along the feeding path FP in order to be coupled to a following

article 11' being processed.

[0046] More precisely, in the non-limiting embodiment of the illustrated figures, in the event a component 11' is defined as defective by the control system 10, the article 3' being processed, rather than being conveyed outside the circuit conveyor system 4, passes the station where it should have been coupled to the component 11' and continues its motion by recirculating on the circuit conveyor system 4 until a new appointment (namely, once the course of the circuit T has been completed) with a following usable component 11" (in particular of as many cycles as the seats 6 of the circuit conveyor system 4).

[0047] In particular, the control unit 17 is configured to move the circuit conveyor system 4 always with the same periodic law of motion, even in the case in which a fed component 11' is defective (as illustrated in the non-limiting embodiment of Figure 3). In fact, by recirculating the article 3' being processed and rejecting only the defective component 11', it is possible to avoid rejecting the part of the semifinished product which up to that moment is usable and therefore to reject only the defective portion, allowing the manufacturer to save raw material, energy and reduce waste in general. In other words, the control unit 17 is configured to dynamically vary the input and output of the articles 3 on the circuit conveyor system 4.

[0048] In particular, an article 3' being processed remains, recirculating, on board of the circuit conveyor system 4 until it is coupled to a usable component 11".

[0049] According to a further aspect of the present invention, a process is provided for the management of waste with recirculation of semifinished articles 3 of the part 2 of the automatic machine 1 for manufacturing or packing consumer articles.

[0050] The aforementioned process firstly comprises the step of conveying, by means of the circuit conveyor system 4 and according to the first periodic law of motion, a plurality of semifinished articles 3 along the conveying path CP. In detail, as previously mentioned, the circuit conveyor system 4 comprises the normally operating portion 8, comprising, in turn, one or more work stations WS, and the normally non-operating portion 9, comprising, in turn, at least one (but potentially also a higher number of) inactive station IS, where the semifinished articles 3 are not subject to further processing (namely, no components are added or removed nor deformed) and are moved only in case of manufacturing or packaging defects of the consumer articles.

[0051] According to the non-limiting embodiment of Figures 2 and 6, the semifinished article 3 passes along the normally non-operating portion 9 of the drum 5 in the event that the component 11' is defective and therefore must be rejected.

[0052] In other non-limiting cases, such as the one illustrated in Figure 2, the semifinished article 3 passes along the normally non-operating portion 9 of the belt 7 in the event that the semifinished article 3 is defective and therefore must be rejected. In this case, by recirculating the article 3 along the normally non-operating por-

tion 9, it is possible to avoid placing waste zones in areas of the machine 1 that are difficult to access; instead allowing an operator to remove the defective product by hand, which continues to recirculate along the circuit T until it is rejected (manually or automatically). In other words, a defective component 11 and/or semifinished article 3 is recirculated from the normally non-operating portion, if unreachable by an operator, to an accessible part of the normally operating portion so that an operator can remove the same.

[0053] The process further comprises checking, in particular in the control area IA, the quality and/or the position and/or the orientation of the article 3' being processed and/or of a component 11, 11" to be added to the article 3' being processed.

[0054] In the event that the article 3' being processed and/or the component 11, 11" is defective, the process provides an advantageous recirculation step, during which the article 3' being processed continues to be conveyed according to the first periodic law of motion through the normally non-operating portion 9 and the at least one inactive station, recirculating by means of the circuit conveyor system 4 until returning to the work station at the normally operating portion 8.

[0055] In the non-limiting embodiments of the Figures from 3 to 6, during the conveying step, the plurality of semifinished articles 3 are conveyed sequentially through at least the work station WS, where the component 11, 11" is added to the article 3' being processed, in particular an inner wrap 11, 11" is added to an already formed group of cigarettes.

[0056] In these non-limiting cases, the process further comprises a feeding step, according to a second periodic law of motion, for each component 11, 11', 11" from the respective store 12 towards the conveying path CP and along the feeding path FP. In particular, the checking step is at least partially simultaneous with the feeding step for the component 11, 11', 11". More precisely, during the checking step the quality and/or the position and/or the orientation of the component 11, 11', 11" are checked and it is established whether the component 11, 11', 11" is usable or defective.

[0057] Furthermore, in these cases, the process comprises a replacement step, during which the defective component 11' is conveyed from the control area IA towards a waste zone WZ (in particular passing through the work station WS) and successively replaced, within the work station WS, by a new component 11", which is fed from the store 12 towards the conveying path CP and along the feeding path FP in order to be coupled to a following article 3' being processed.

[0058] Advantageously but not restrictively, the recirculation step and the replacement step are at least partially simultaneous with one another.

[0059] Preferably, the recirculation step ends when the article 3' being processed reaches again the work station WS.

[0060] In some non-limiting cases such as those of Fig-

ures from 3 to 6, during the recirculation step, the article 3' being processed is only conveyed (and therefore not processed again) through possible further work stations WS' where it was already processed.

[0061] According to some non-limiting embodiments, such as those illustrated in Figures from 3 to 6, the article 3' being processed is conveyed, by means of the circuit conveyor system 4, from an input station 18 to an output station 19, both arranged along the conveying path CP and between which a coupling station 20 is arranged, where each component 11, 11" is placed in the area of a peripheral portion 21 of the circuit conveyor system 4 and moved together with the same in an integral manner from the coupling station 20 to the work station WS (which, in the illustrated case, corresponds to the output station 19); in particular, each component 11, 11" is arranged so as to be integral with at least a portion of the article 3' being processed (for example the one corresponding to the bottom or the head of a future packet of cigarettes).

[0062] Advantageously but not restrictively, the control area IA is interposed between the coupling station 20 and the output station 19.

[0063] According to some preferred non-limiting embodiments, such as the one illustrated in Figure 6, in the case in which, during the recirculation step, the article 3' being processed is located at the input station 18, the same is selectively disabled by the insertion of new semifinished articles 3. In other words, a system for inserting the semifinished articles 3 into the seats 6 of the circuit conveyor system 4.

[0064] In some preferred non-limiting cases, the checking step is carried out by means of an optical control system 10, preferably by means of a pair of photodetectors 14 arranged along an axis A transverse to the conveying path CP. In particular, the axis A transverse to the conveying path CP is perpendicular to the latter.

[0065] Advantageously but not necessarily, the part 2 of the automatic machine 1 also comprises a plurality of pushing elements (of a known type and not illustrated for simplicity), which are controlled by the control unit 13 to introduce or extract the semifinished articles 3 or the articles 3' being processed in or from the circuit conveyor system 4.

[0066] In the non-limiting embodiments illustrated in Figures from 3 to 6, at least four actuators 15, 17 and two pushing elements are provided: a first actuator 15 is coupled to the drum 5 to control the rotation of the drum around its rotation axis and is provided with a rotating electric motor (for example of the *brushless* type) that rotates the drum 5, by means of the interposition of a reducer (not illustrated), to move the seats 6 and the articles 3' being processed from a station 18, 20, 19, IS, to the other; a second actuator (not illustrated) is coupled to the input pushing element to control the linear movement of the semifinished articles 3 along the conveying path CP and for a predefined stroke and is preferably provided with a rotating electric motor (for example of the

brushless type) and a reducer that transforms the circular movement into linear movement (both not illustrated); a third actuator 17 connected to the store 12 and configured to feed the components 11 along the feeding path FP (obviously, the actuator 17 in the illustrated embodiment moves a respective wheel, but it can be any other type of actuator comprising, for example, articulated quadrilaterals, robots, picking and placing elements, etc.).

[0067] Advantageously but not necessarily, the step of checking the quality and/or the position and/or the orientation of the component 11, 11', 11" is repeated cyclically for each new component 11" that passes along the feeding path FP (namely, for each component that passes through the control area IA and interrupts the beam of the photodetectors 14).

[0068] Advantageously but not necessarily, upon exceeding a predefined number of defective components 11' (for example five), namely, of recirculated semifinished articles 3', the control system 10 signals an error to the control unit 13 and the part 2 of the automatic machine 1 stops in a controlled manner, in particular by reporting the error to a machine operator or to a management system. In these cases, the succession of several consecutive defective components 11' means that a part or a station of the machine 1 along the feeding path FP is ruining the components 11 or that the store 12 (or reel) needs to be changed as it is damaged (perhaps during the transport to the production site).

[0069] In some non-limiting embodiments, such as the one illustrated in Figure 6, the defective component 11' is rejected moving on along the feeding path FP and passing through the conveying path CP. In this way, the defective component 11' is dropped (or led) into the waste zone WZ and the following new component 11" continues its course towards the conveying path CP and is arranged in the work station WS (in particular in output station 19).

[0070] In other non-limiting and non-illustrated embodiments, the defective component 11' is rejected within the waste zone WZ without passing through the work station WS (for example by means of a special unloading, suction, exchange system, etc.).

[0071] In use, as illustrated in the non-limiting embodiment of Figures 3 and 4, the drum 5 is a wheel with four seats 6, equally spaced from one another and therefore arranged every 90° on the circuit T. In particular, the articles 3 are moved inside the pocket 6 provided at the input station 18. In the same figures, the next two steps of the first periodic law of motion are provided, in which the article 3' is moved from the input station 18 to the coupling station 20, wherein a component 11 (which is not yet known whether it is usable or not), fed by the system 16 along the feeding path FP, is coupled (with known and not illustrated methods, for example by means of tweezers or perimeter magnets of the drum 5) to the article 3' being processed at the coupling station 20. In other words, the component 11 holds a position and an orientation during the coupling step at the periph-

eral area 21 of the drum 5. Continuing along the conveying path CP, the component 11 necessarily passes through the control area IA, where the pair of photodetectors 14 determines its positioning (alternatively, one or more photos could be taken by the vision system). The control system 10, namely, the photodetectors 14, therefore allow the control unit 13 to assess whether the component 11 passing from the coupling station 20 to the output station 19 is usable or not.

[0072] In the event that the component 11 is usable, the process provides for moving on to the situation in Figure 5, in which a special pushing element moves the article 3' being processed at the output station to be housed inside the seat of the following transport system (which can be a further wheel, or a conveyor belt provided with seats) and then be wrapped within the component 11 itself, in the event that the same is an inner wrap.

[0073] In the event that the component 11 is not usable, the process provides for moving to the situation of Figure 6, in which the defective component 11' is conveyed towards the waste zone WZ and the article 3' being processed coupled thereto moves to occupy the normally non-operating portion 9, namely, the inactive station IS for at least one cycle time of the drum 5 at a periodic step. In this way, the drum 5, or the actuator 15, is operated in any case according to the first law of motion, which is not varied, and the article 3' being processed coupled to the defective component 11' is recirculated.

[0074] In the event that the new component 11" is assessed as usable by the control system 10, the article at the output station 19 is expelled from the respective pushing element and the condition of Figure 4, in which the inactive station IS is empty, is reinstated. Alternatively, the articles 3' being processed are recirculated and the feeding of new semifinished articles 3 into the conveyor system 4 is inhibited.

[0075] Advantageously but not necessarily, the automatic machine 1 is configured to carry out the process described up to this point.

[0076] Although the invention described above makes particular reference to a very specific example of embodiment, it is not to be considered limited to said example of embodiment. All the alternatives, modifications or simplifications that would be clear to the skilled in the art fall within its scope, such as for example: the addition of additional actuators, the use on another type of machine for manufacturing or packing consumer articles other than a cigarette packaging machine, the use of sets of movements generated with trajectories or algorithms different from those mentioned, the use of different types of component or article, the use of different conveying and feeding systems, etc.

[0077] The present invention has multiple advantages. Most importantly it allows only defective components to be rejected and not an entire article in which also a plurality of usable components are provided. In this way, the efficiency of the manufacturer improves in terms of waste of usable material, waste is generally reduced and there-

fore there is greater sustainability of the process and lower disposal and raw material costs.

[0078] Furthermore, the possibility of independently controlling the various actuators and checking the quantity of consecutive waste makes it possible to prevent the machine from jamming out of control, allowing, at the same time, the completion of the production of the articles downstream of the part of the machine which stops in step.

[0079] In addition, the possibility of controlling the conveying of the articles and the feeding of the components in a diversified manner allows the recirculation of good quality semifinished articles and to reject only the defective components.

[0080] Finally, the recirculation of components in normally non-operational areas of transport systems also allows to avoid having waste zones in inaccessible areas, as defective articles can be recirculated to easily accessible areas, where they can be rejected automatically or by an operator.

Claims

1. A process for the management of waste with recirculation of semifinished articles (3) of at least part (2) of an automatic machine (1) for manufacturing or packing consumer articles; the process comprises the steps of:

- conveying, by means of a circuital conveyor system (4) and according to a first periodic law of motion, a plurality of semifinished articles (3) along a conveying path (CP);

wherein the circuital conveyor system (4) comprises a normally operating portion (8) comprising in turn, one or more work stations (WS), and a normally non-operating portion (9) comprising, in turn, at least one inactive station (IS); the normally operating portion (8) and the normally non-operating portion (9) being contiguous and consecutive to one another on the circuital conveyor system (4);

- checking, in a control area (IA), the quality and/or the position and/or the orientation of an article (3') being processed and/or of a component (11, 11") to be added to the article (3') being processed;

the process being **characterized in that** it comprises, in case the article (3') being processed and/or a component (11, 11") are defective:

- a recirculation step, during which the article (3') being processed continues to be conveyed according to the first periodic law of motion through the normally non-operat-

ing portion (9) and said at least one inactive station (IS), recirculating, by means of the circuital conveyor system (4), until returning to the normally operating portion (8).

2. The process according to claim 1, wherein, during the conveying step, said plurality of semifinished articles (3) are conveyed through said at least one work station (WS), where the component (11, 11") is added to the article (3') being processed; the process further comprising the steps of:

- feeding, according to a second periodic law of motion, each component (11, 11', 11") from a respective store (12) towards the conveying path (CP) and along a feeding path (FP);

wherein the checking step is at least partially simultaneous with the step of feeding the component (11, 11', 11"); during the checking step, the quality and/or the position and/or the orientation of the component (11, 11', 11") are checked and the component (11, 11', 11") is established to be usable or defective;

- a replacement step, during which the defective component (11') is conveyed from the control area (IA) towards a waste zone (WZ) and replaced, in the work station (WS), by a new component (11"), which is fed from the store (12) towards the conveying path (CP) and along the feeding path (FP) in order to be coupled to a following article (3') being processed.

3. The process according to claim 2, wherein the replacement step and the recirculation step are at least partially simultaneous.
4. The process according to claim 2 or 3, wherein the recirculation step ends when the article (3') being processed reaches again the work station (WS).
5. The process according to claim 4, wherein, during the recirculation step, the article (3') being processed is only conveyed through possible further work stations (WS), from which it has already been processed.
6. The process according to any one of the claims from 2 to 5, wherein the article (3') being processed is a group of cigarettes and the component (11, 11") is an inner wrap.
7. The process according to any one of the claims from 2 to 6, wherein the article (3') being processed is conveyed, by means of the circuital conveyor system (4), from an input station (18) to an output station (19), which are arranged along the conveying path (CP) and between which a coupling station (20) is

arranged, where each component (11, 11', 11") is placed in the area of a peripheral portion (21) of the circuital conveying system (4) and moved together with the same in an integral manner from the coupling station (20) to the work station (WS); wherein the control area (IA) is interposed between the coupling station (20) and the output station (19).

8. The process according to claim 7, wherein the input station (18) is selectively disabled by the insertion of new semifinished articles (3) if, during the recirculation step, the article (3') is located in the area of the input station (18).

9. The process according to any one of the claims from 2 to 8, wherein the checking step is carried out by means of an optical control system (10), preferably by means of a pair of photodetectors (14) arranged along an axis (A) transverse to the conveying path (CP).

10. The process according to any one of the preceding claims, wherein the step of checking the quality and/or the position and/or the orientation of the component (11, 11', 11") is cyclically repeated for each new component (11") passing through the control area (IA) and along the feeding path (FP).

11. The process according to any one of the preceding claims, wherein, upon exceeding a predefined number of recirculated semifinished articles (3'), the part (2) of the automatic machine (1) is stopped in a controlled manner, in particular signalling an error to an operator or to a management system.

12. The process according to any one of the preceding claims, wherein a defective component (11) and/or a defective semifinished article (3) are rejected moving on along the feeding path (FP) and passing through the conveying path (CP).

13. The process according to any one of the claims from 1 to 11, wherein a defective component (11) and/or a defective semifinished article (3) are recirculated from the normally non-operating portion (9), if it can be reached by an operator, to an accessible part of the normally operating portion (8) so that an operator can remove the same.

14. An automatic machine (1) for manufacturing or packing consumer articles (3); the automatic machine (1) comprises:

- a circuital conveyor system (4), which is configured to convey, singularly or in groups, a plurality of semifinished articles (3) through at least one work station (WS) along a conveying path (CP) and according to a first periodic law of mo-

tion; wherein the circuital conveyor system (4) comprises a normally operating portion (8) comprising in turn, one or more work stations (WS), and a normally non-operating portion (9) without work stations (WS); the normally operating portion (8) and the normally non-operating portion (9) being contiguous and consecutive to one another on the circuital conveyor system (4);

- a control system (10) configured to detect the quality and/or the position and/or the orientation of an article (3') being processed and/or of a component (11, 11") to be added to the article (3') being processed so as to establish whether the component (11) is usable or defective; and;
- a control unit (17) configured to control at least the conveyor system (4);

the automatic machine (1) is **characterized in that:** the control unit (17) is configured to control, in case the fed component (11') and/or the article (3') being processed are defective, the circuital conveyor system (4) so as to recirculate the article (3') being processed, which continues being conveyed according to the first periodic law of motion through the normally non-operating portion (9), recirculating, by means of the circuital conveyor system (4), until returning to the normally operating portion (8).

15. The machine (1) according to claim 14 and comprising:

- at least one store (12) containing one or more components;
- a feeding system (16) configured to feed at least one component (11) from the respective store (12) towards the conveying path (CP) through at least one work station (WS), where the component (11, 11") is added to the article (3') being processed;
- a waste zone (WZ) configured to receive possible defective components;

the control unit (17) is configured to control, in case the fed component (11') is defective, the feeding system (16) so as to replace the defective component (11') and to convey the defective component (11') from the control area (IA) towards a waste zone (WZ) as well as to replace the same, in the work station (WS), with a new component (11"), which is fed from the store (12) towards the conveying path (CP) and along the feeding path (FP) in order to be coupled to a following article (3') being processed.

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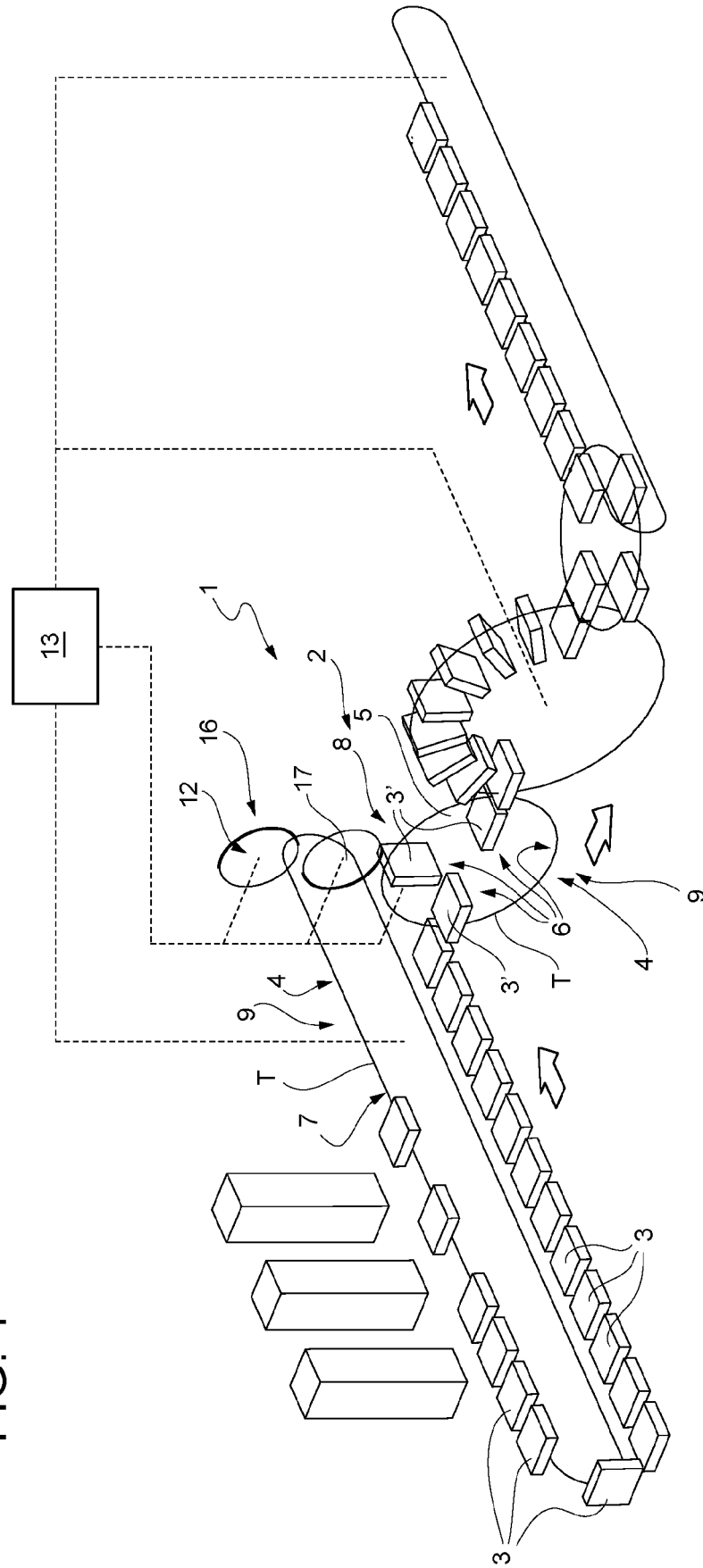


FIG. 1

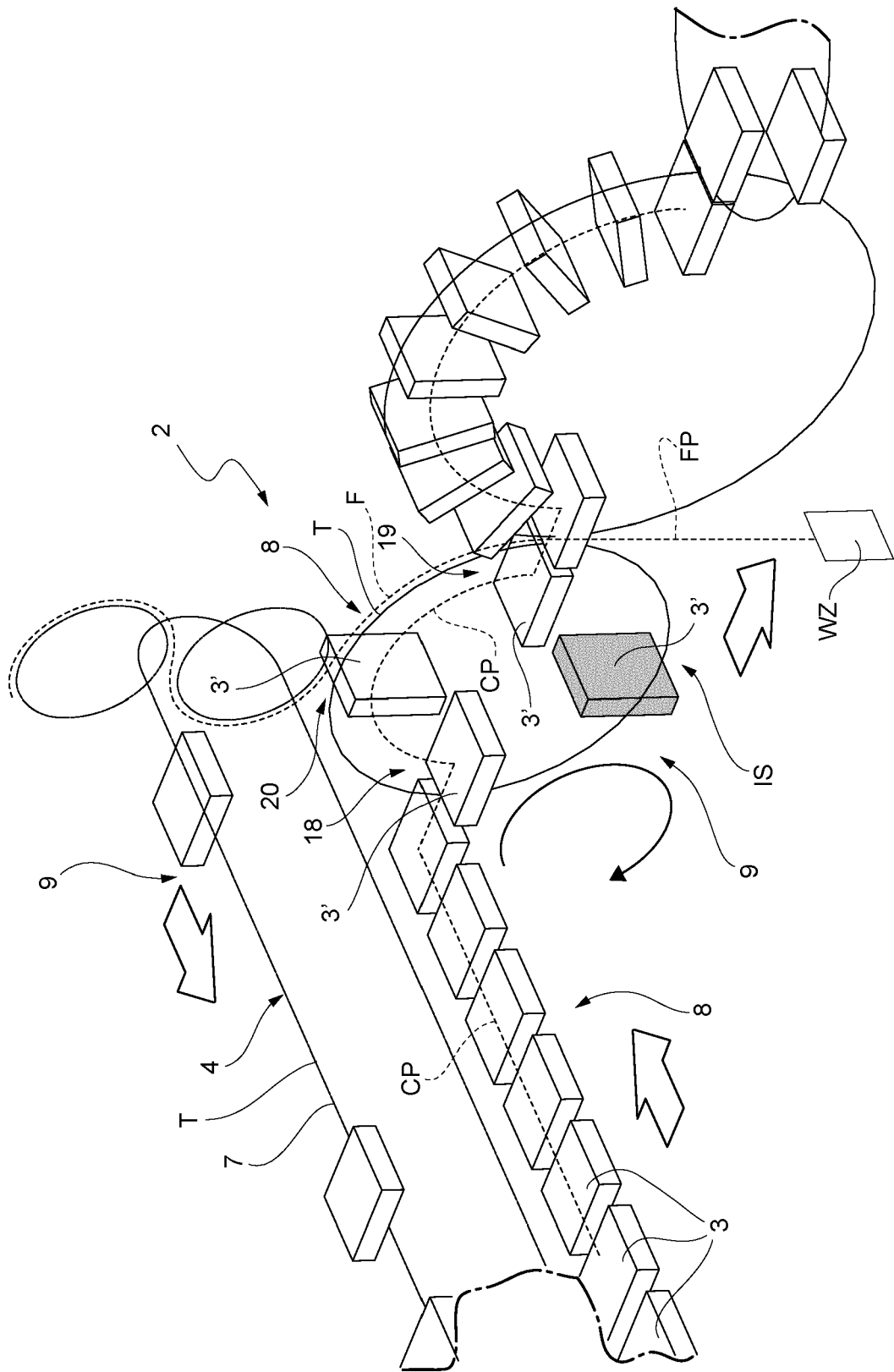
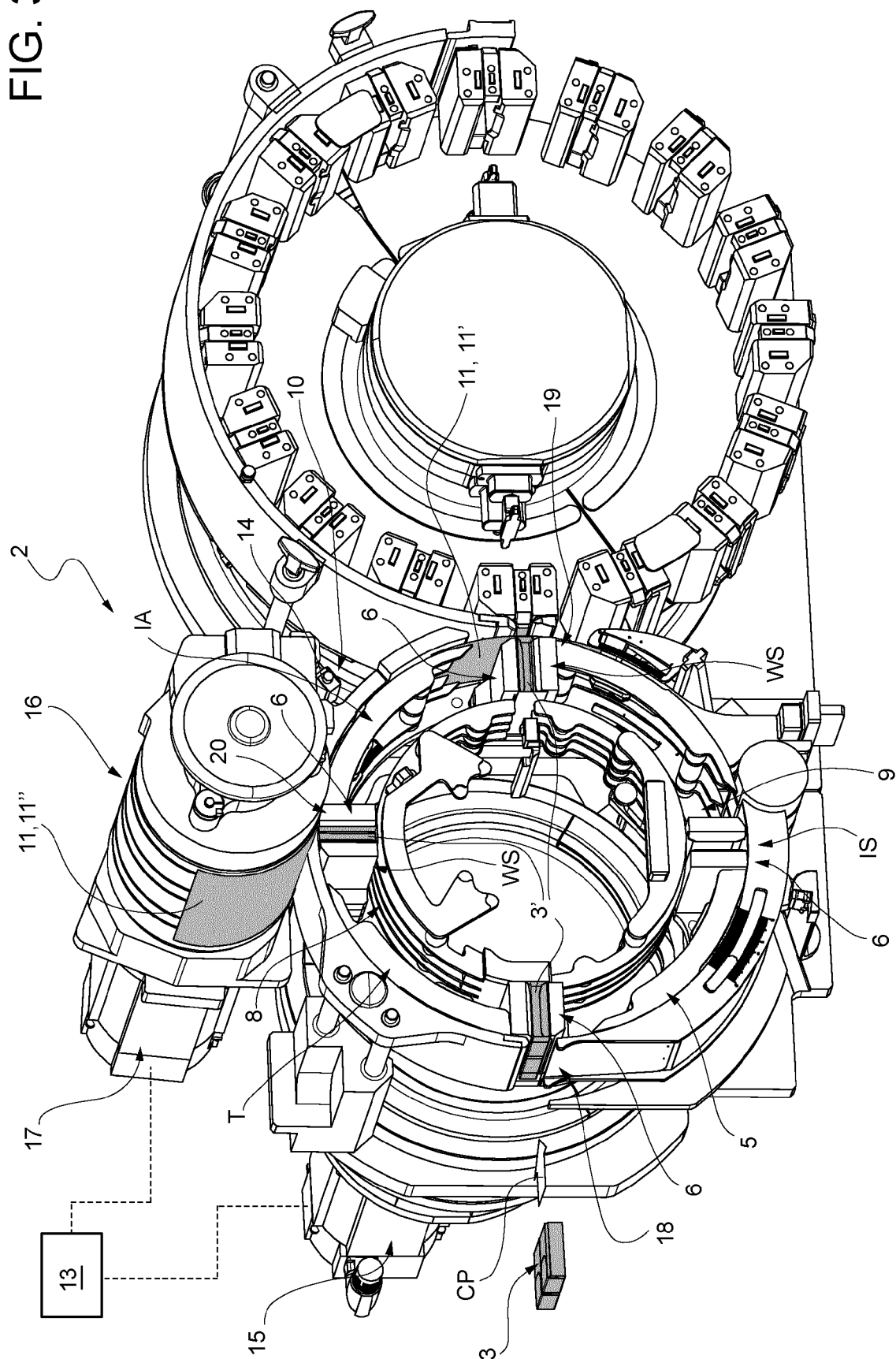


FIG. 3



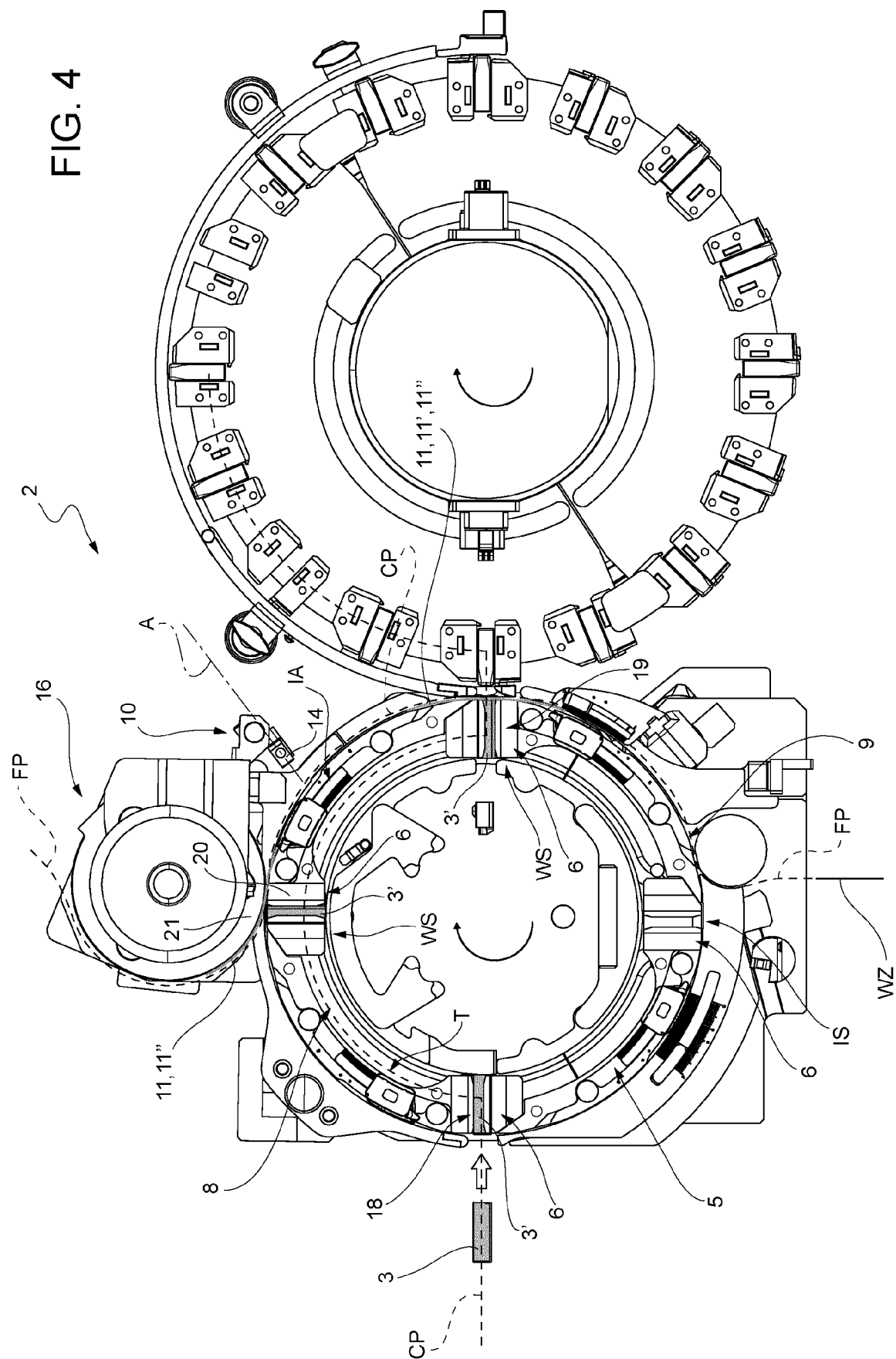


FIG. 5

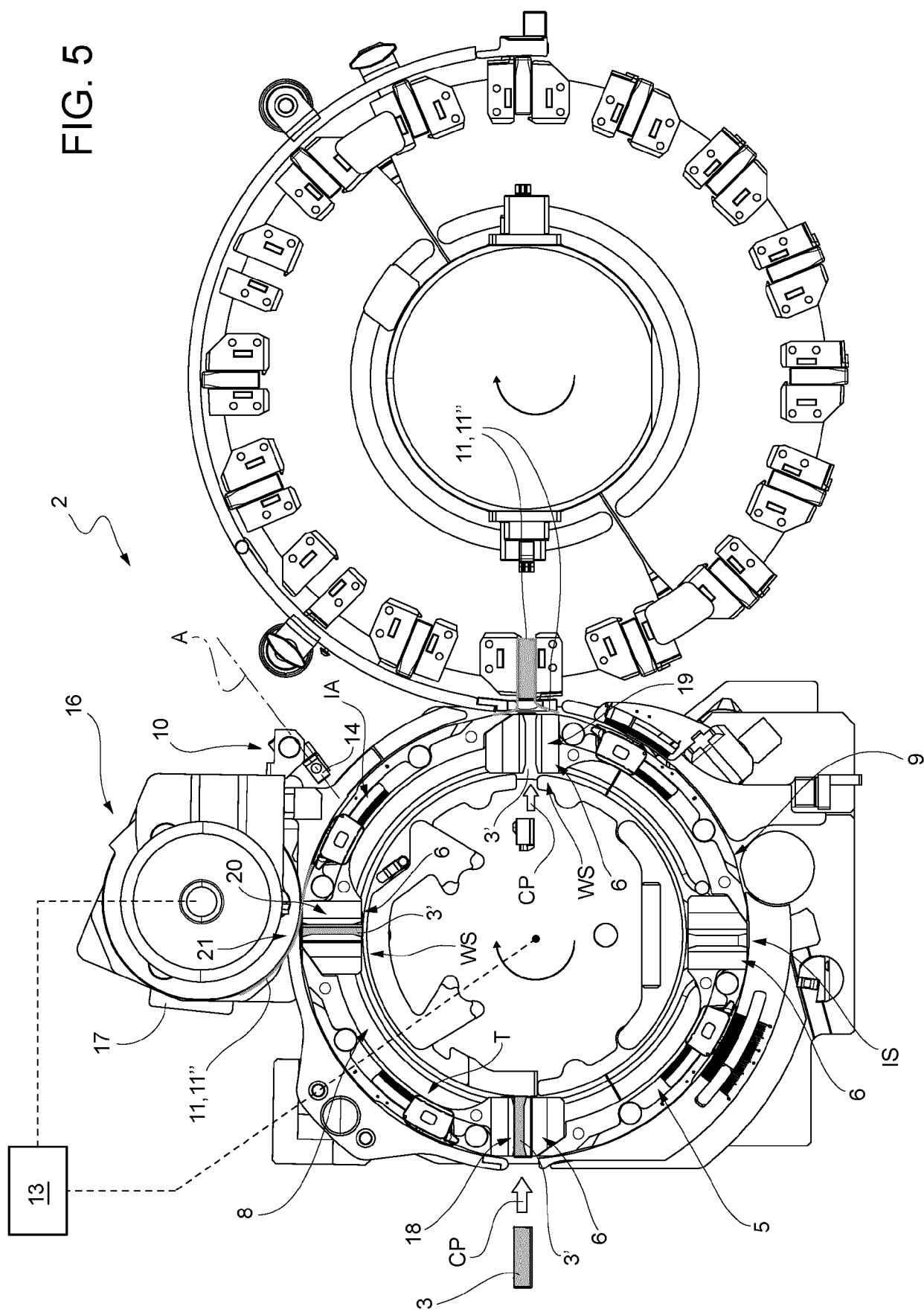
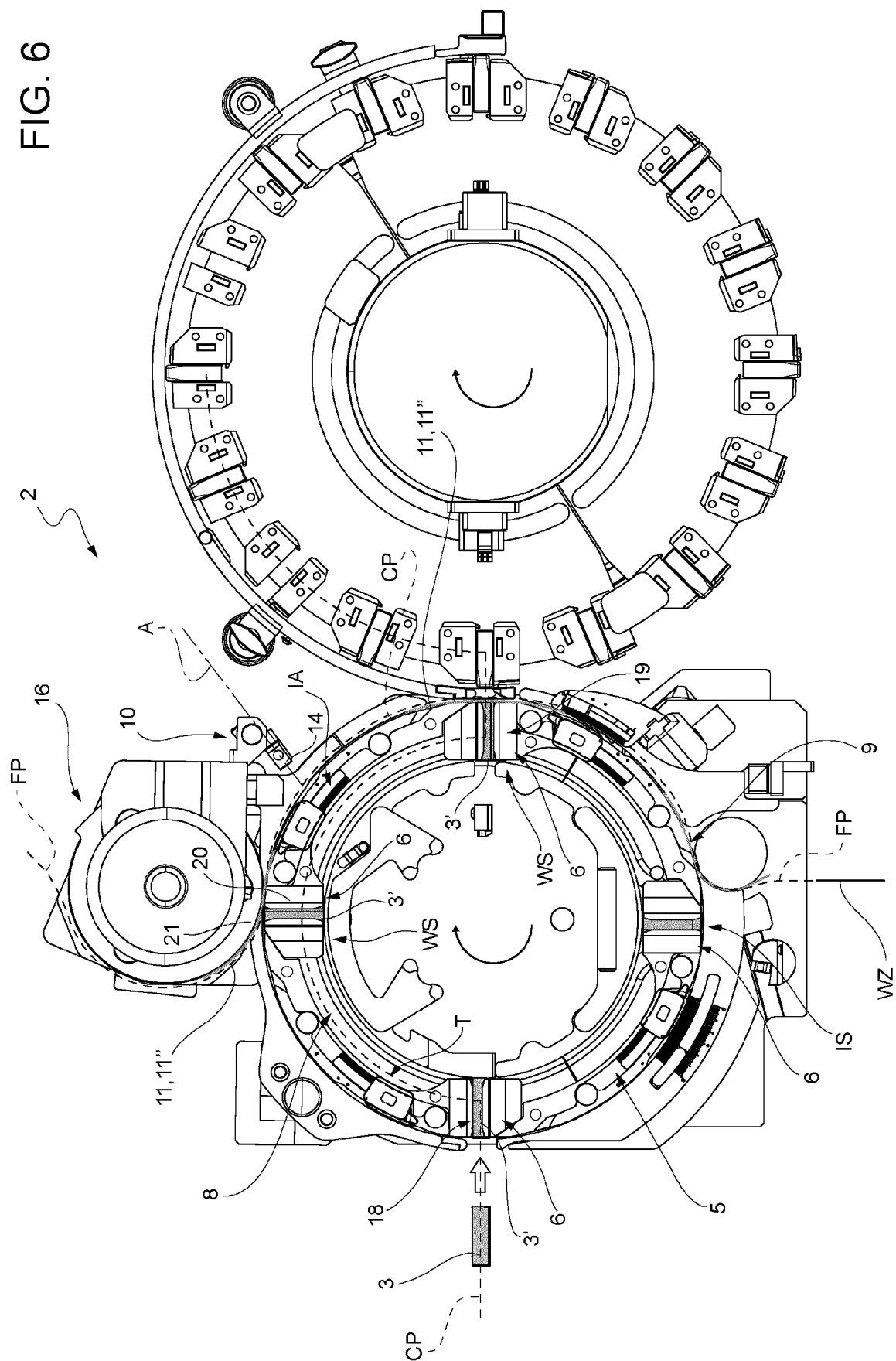


FIG. 6





EUROPEAN SEARCH REPORT

Application Number

EP 23 20 4874

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 3 735 767 A (KRUSE F ET AL) 29 May 1973 (1973-05-29) * see in particular the passages mentioned in the written opinion;; the whole document * -----	1-15	INV. B65B11/28 B65B19/22 B65B19/28 B65B35/26 B65B35/46 B65B57/04 B65B61/20
			TECHNICAL FIELDS SEARCHED (IPC)
			B65B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 15 March 2024	Examiner Paetzke, Uwe
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15-03-2024

10	Patent document cited in search report	Publication date	Patent family member(s)	Publication date
15	US 3735767	A	29-05-1973	NONE
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40				
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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