US012390850B2

(12) **United States Patent**
Boldrini

(10) **Patent No.: US 12,390,850 B2**
(45) **Date of Patent: Aug. 19, 2025**

(54) **METHOD AND MACHINE TO MANUFACTURE ONE OR MORE COILS AROUND RESPECTIVE ARTICLES**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 254 days.

(21) Appl. No.: **18/053,339**

(22) Filed: **Nov. 7, 2022**

(65) **Prior Publication Data**

US 2023/0150011 A1 May 18, 2023

(30) **Foreign Application Priority Data**

Nov. 15, 2021 (IT) 102021000028892

(51) **Int. Cl.**
B21F 3/00 (2006.01)
H01F 41/09 (2016.01)

(52) **U.S. Cl.**
CPC ***B21F 3/00*** (2013.01); ***H01F 41/09*** (2016.01)

(58) **Field of Classification Search**
CPC H01F 41/09; H01F 41/096; H01F 41/098; H01F 41/06; H01F 41/071; H01F 41/076;
(Continued)

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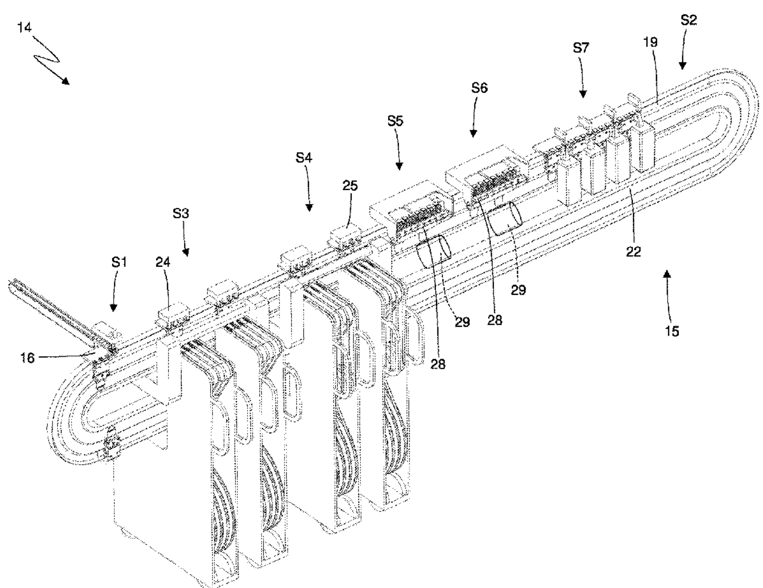
(57) **ABSTRACT**

A method and an automatic machine to manufacture one or more coils around respective articles. The following steps are provided: moving, by means of a main conveyor and along a processing path, a plurality of carriages, each provided with at least one seat designed to house an article; placing, in an input station arranged along the processing path, each article in the seat of a corresponding carriage; coupling, in at least one of two winding stations arranged one after the other along the path, a wire around an article carried by a carriage to create a corresponding coil; using, when they are both working, the two winding stations together and in parallel, having each winding station operate at a first production speed; and using, when a winding station is not working, only the other winding station, operates at a second production speed, higher than the first production speed.

17 Claims, 10 Drawing Sheets



(58) **Field of Classification Search**
CPC ... H01F 41/04; B21F 3/00; B21F 3/02; H02K 15/00
USPC 242/437.3
See application file for complete search history.

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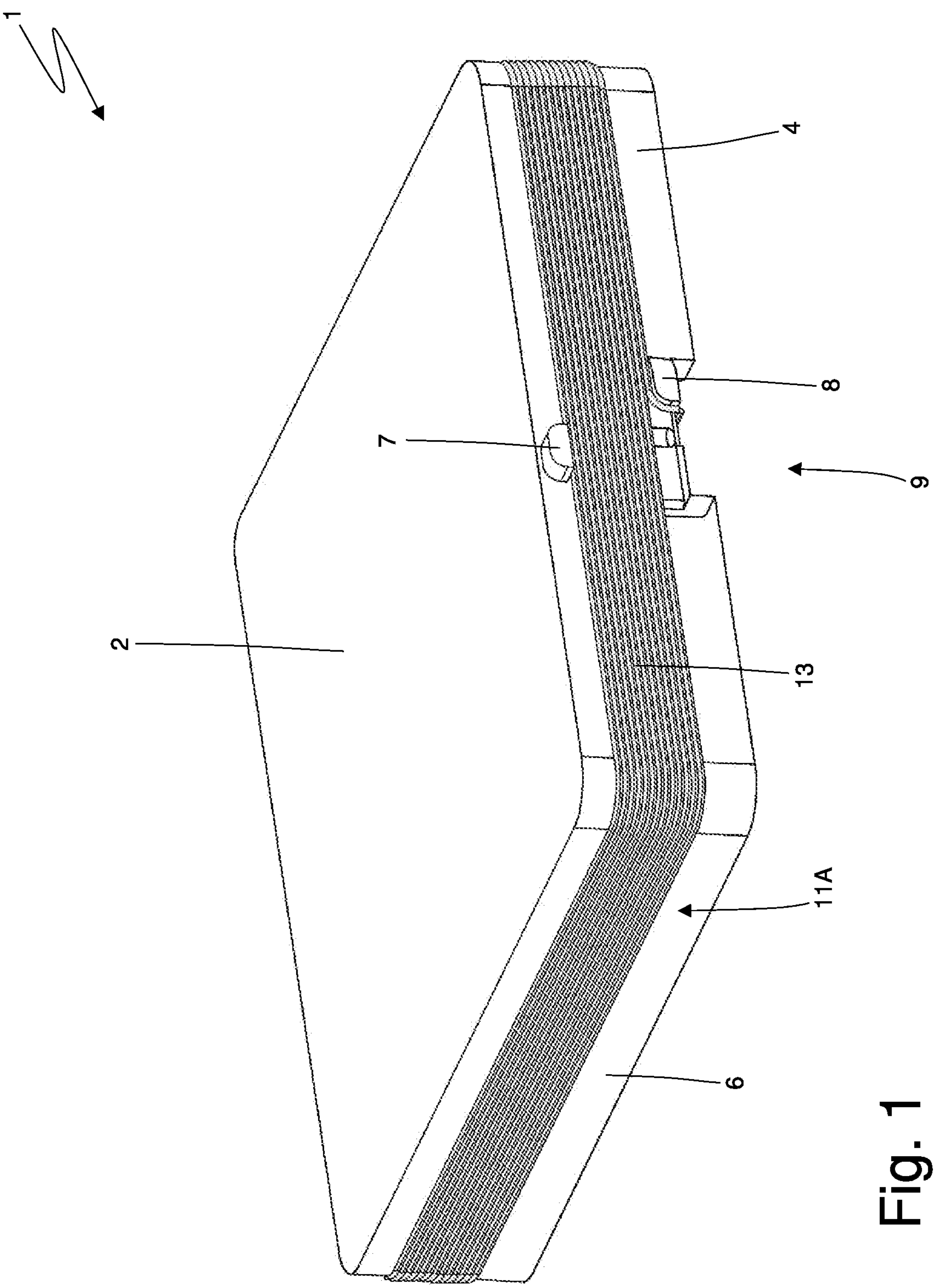

Fig. 1

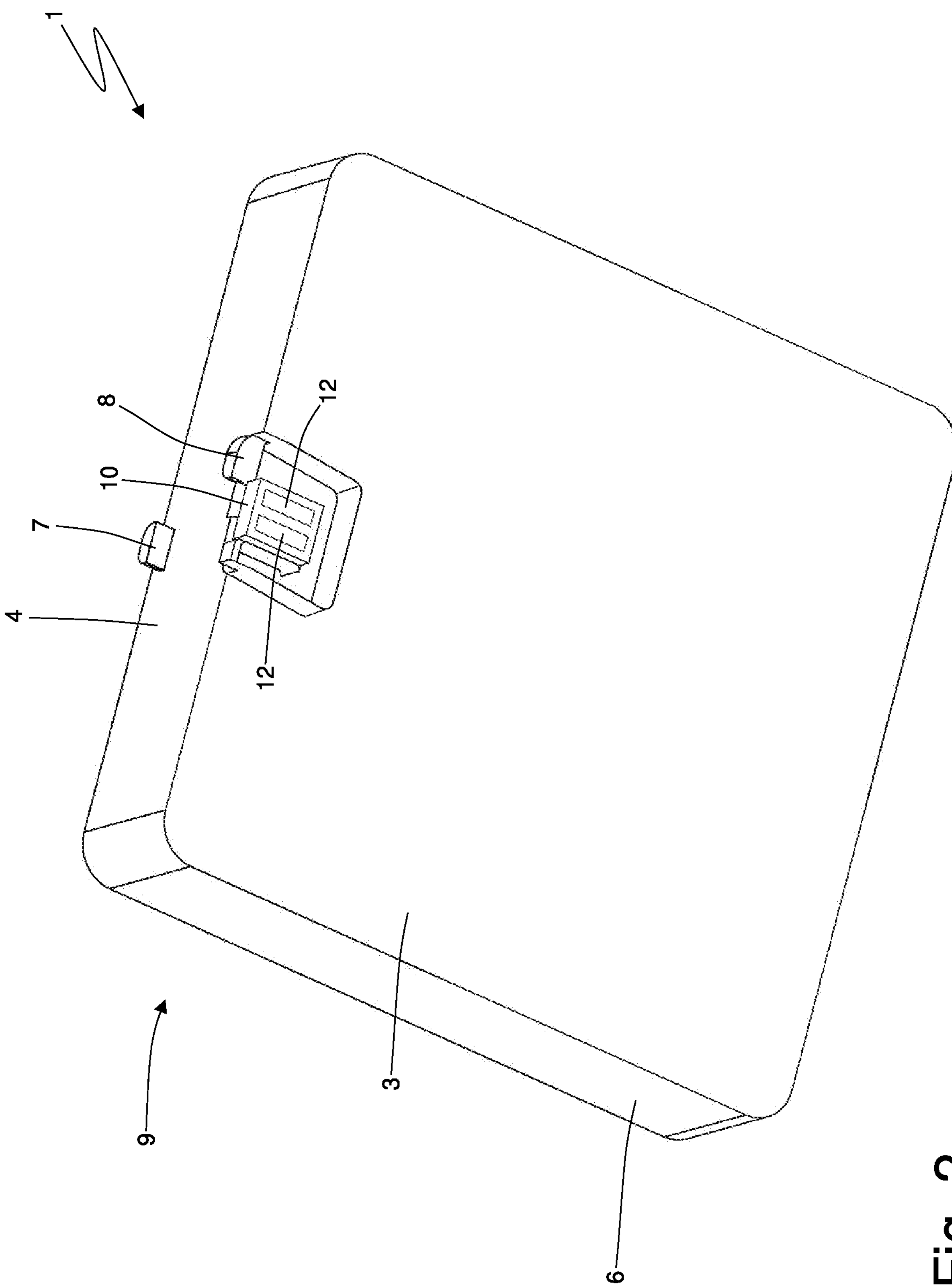

Fig. 2

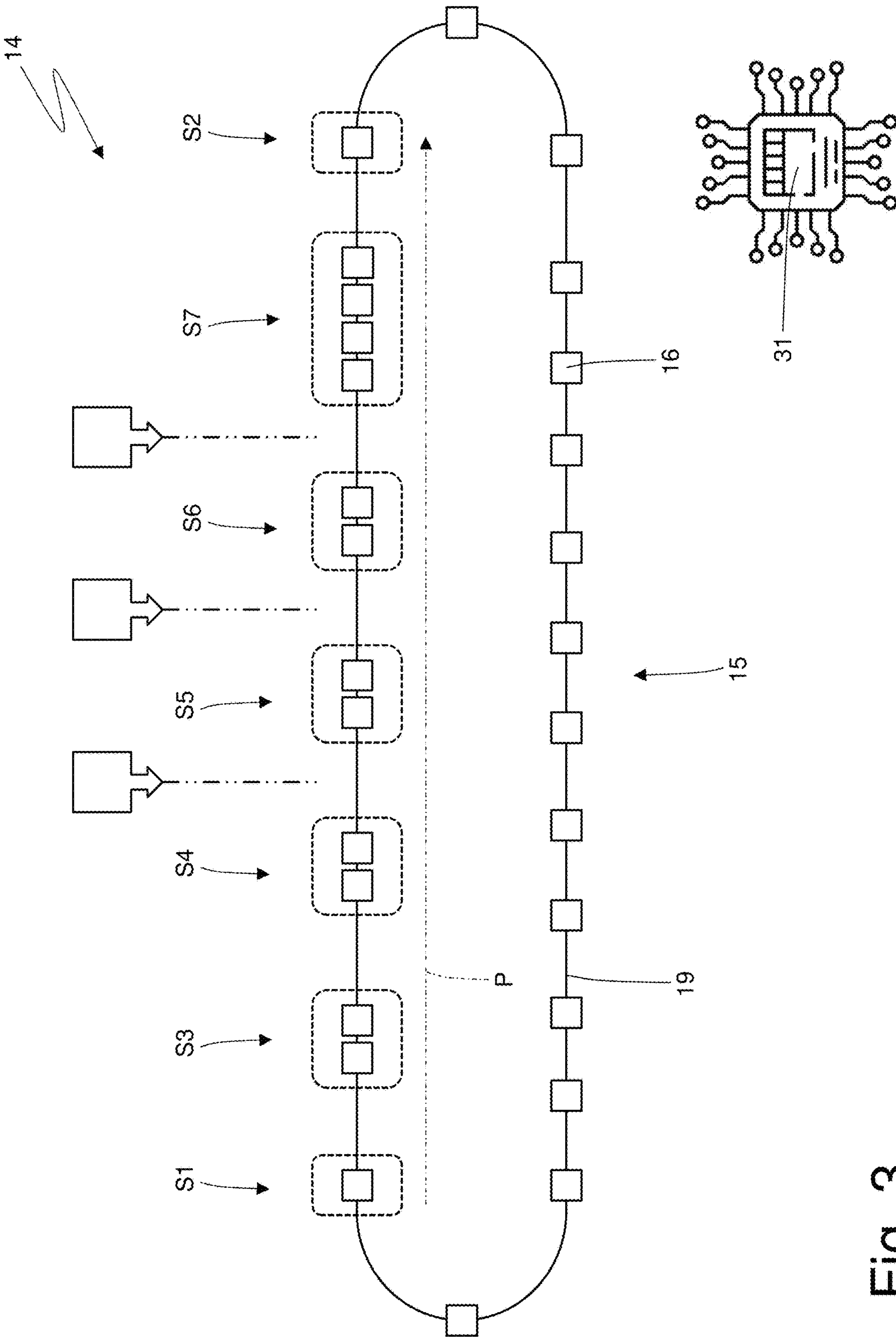

Fig. 3

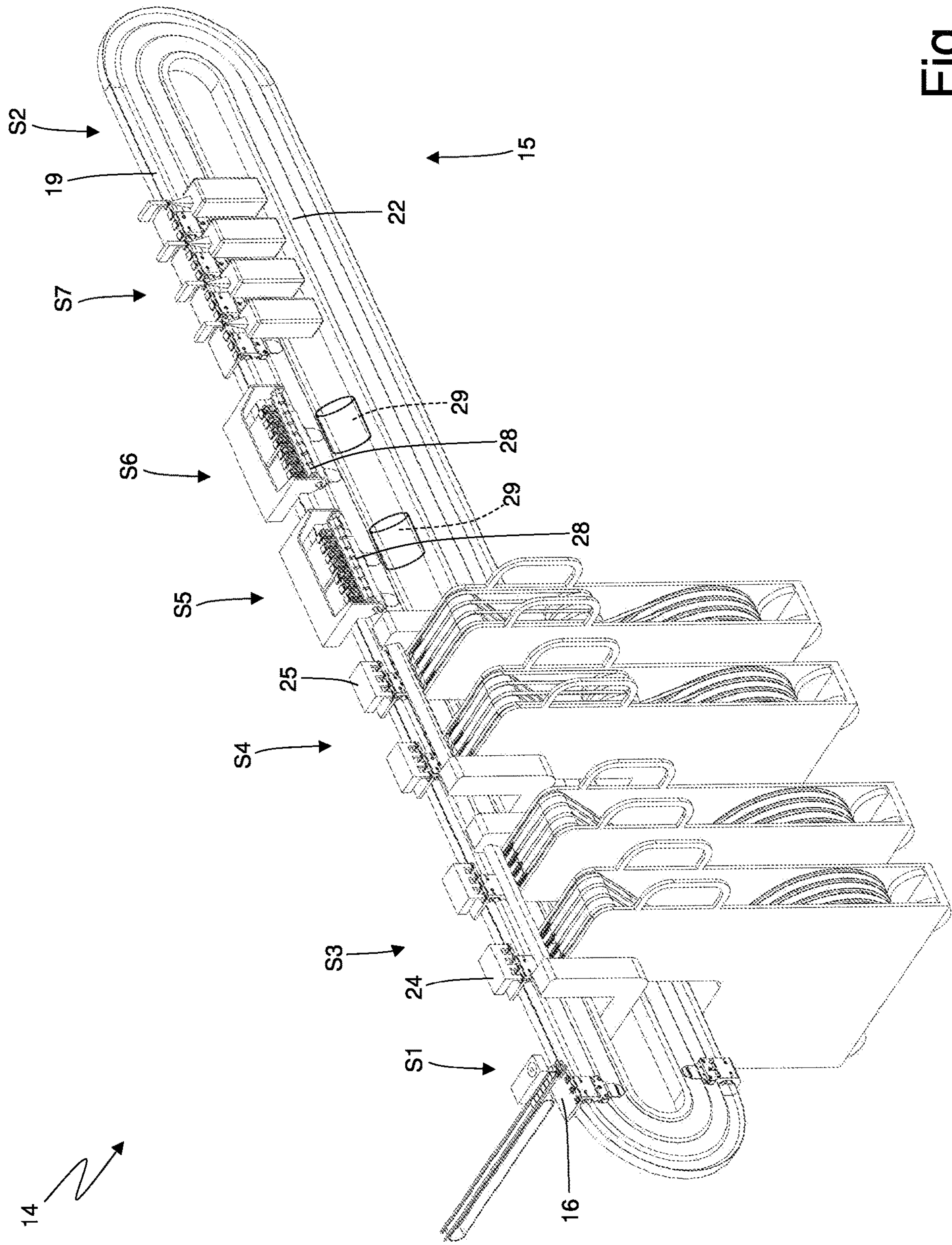

Fig. 4

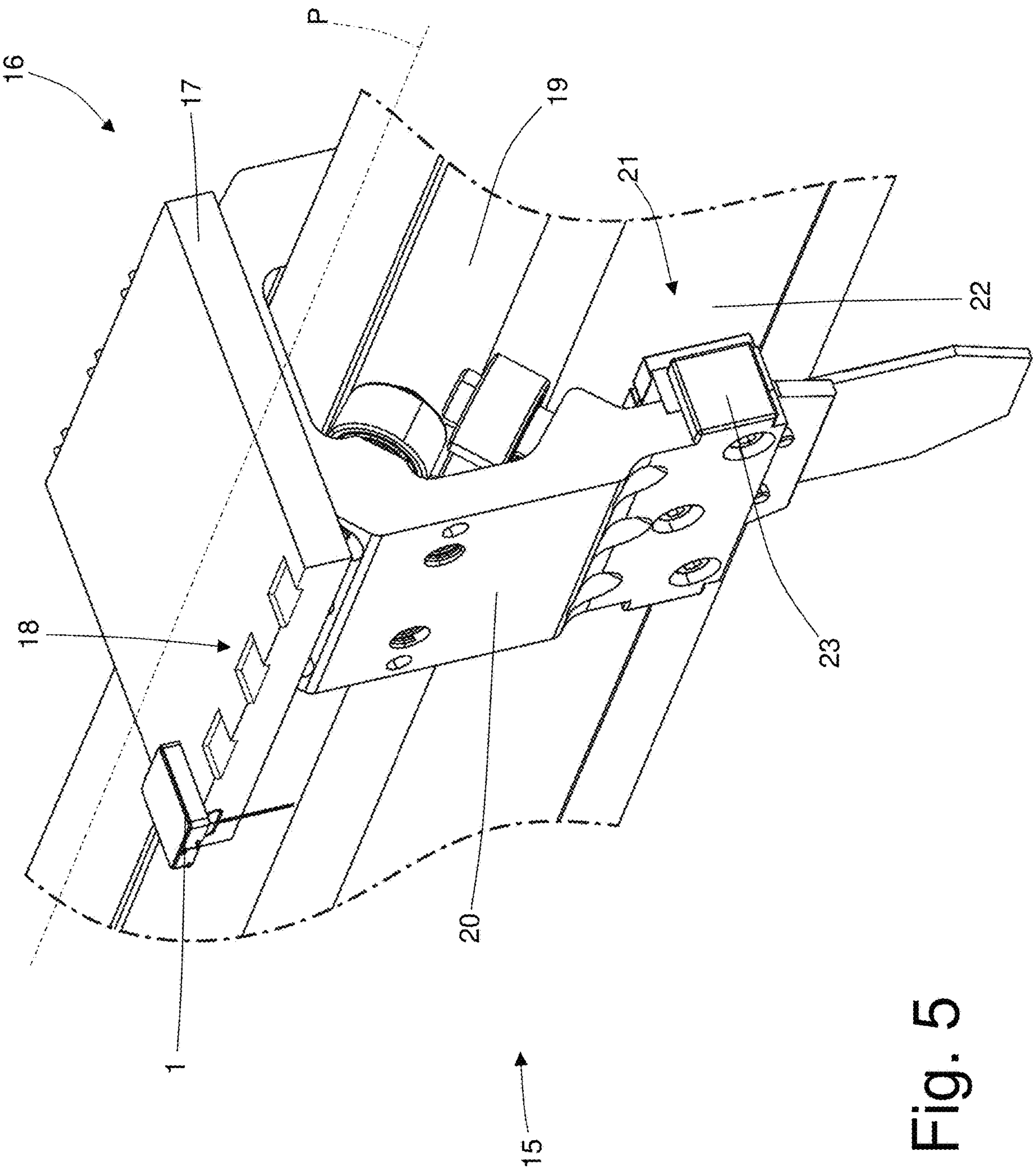

Fig. 5

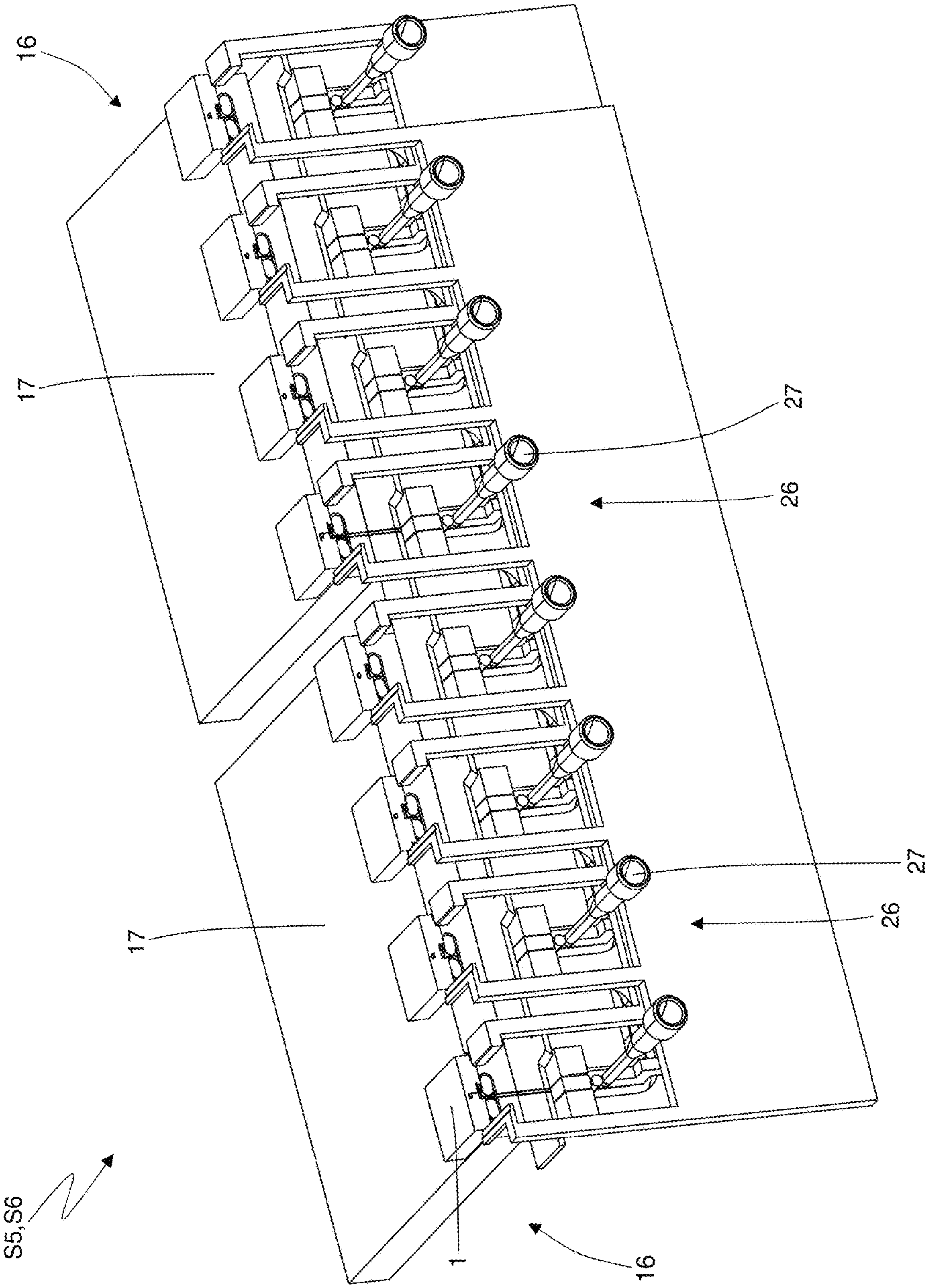

Fig. 6

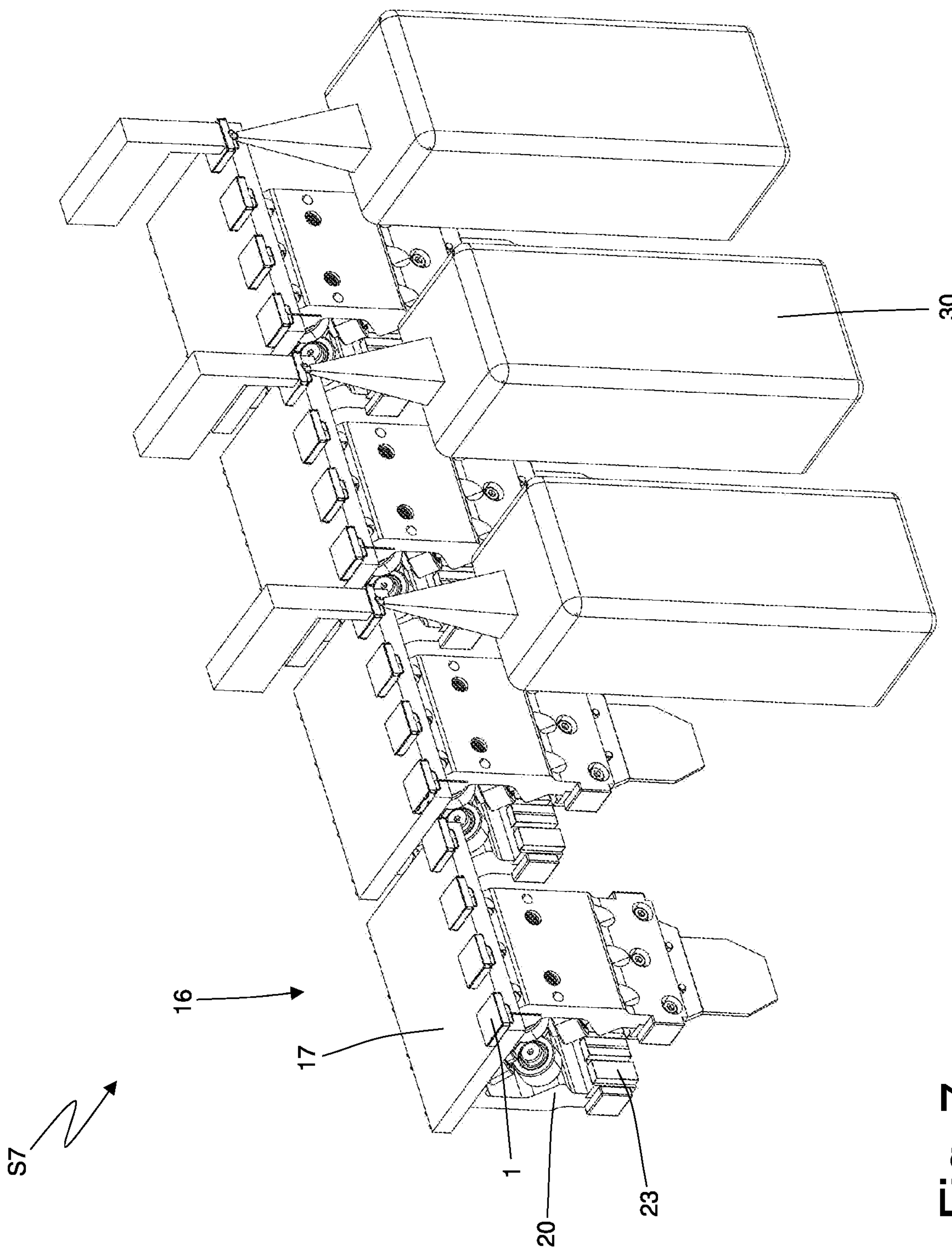

Fig. 7

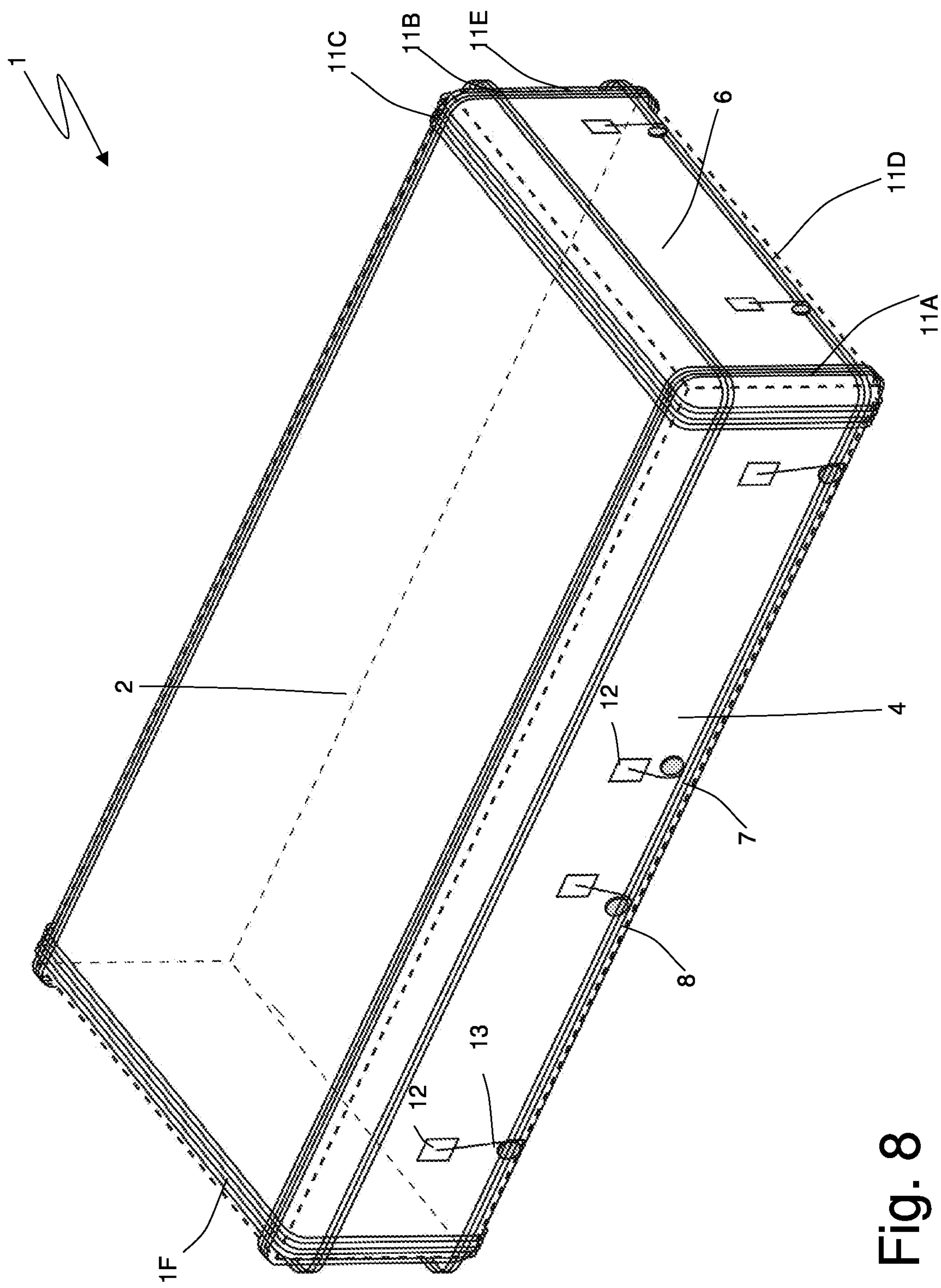

Fig. 8

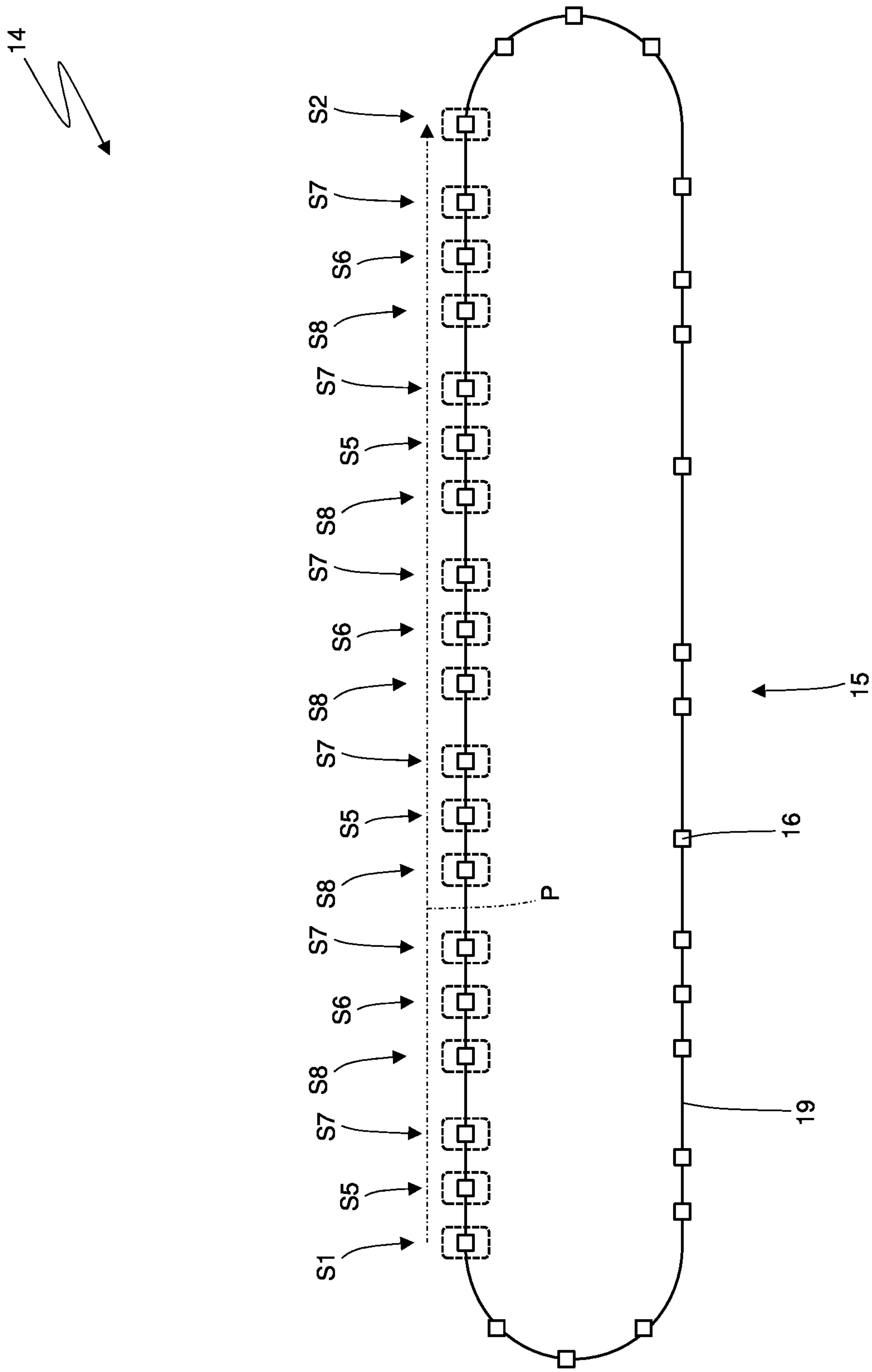

Fig. 9

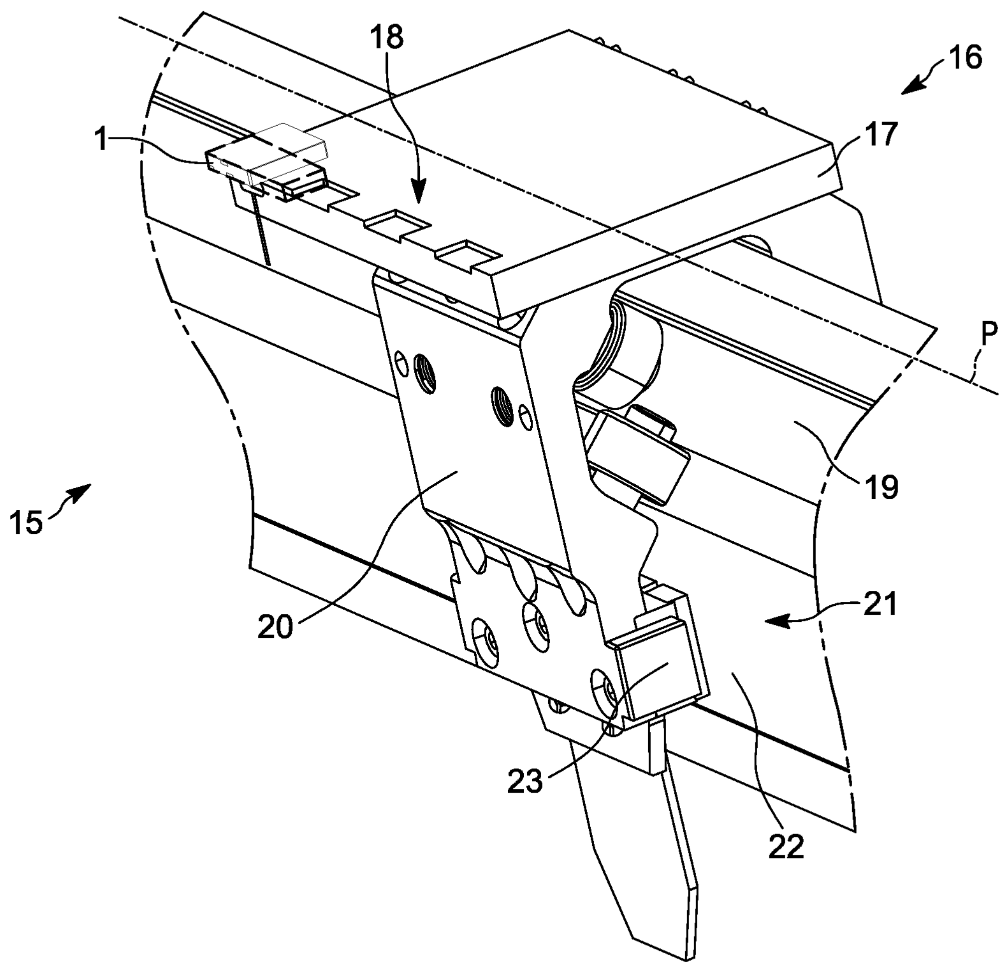

Fig. 10

METHOD AND MACHINE TO MANUFACTURE ONE OR MORE COILS AROUND RESPECTIVE ARTICLES

CROSS-REFERENCE TO RELATED APPLICATIONS

This patent application claims priority from Italian patent application no. 102021000028892 filed on Nov. 15, 2021, the entire disclosure of which is incorporated herein by reference.

FIELD OF THE DISCLOSURE

The invention relates to a method and a machine to manufacture one or more coils around respective articles.

The invention is advantageously applied in the tobacco industry in order to assemble a transponder in a component of a disposable cartridge of an electronic cigarette, to which explicit reference will be made in the description below without because of this losing in generality.

BACKGROUND

An electronic cigarette normally comprises a re-usable part, which is used several times and contains, among other things, an electric battery (which provides the power needed for the operation of the electronic cigarette) and an electronic processor, which controls the operation of the electronic cigarette. Furthermore, the electronic cigarette comprises a disposable cartridge (namely to be used one single time and to be then replaced), which is coupled to the re-usable part.

Recently, a disposable cartridge was developed, which is provided with a transponder equipped with a memory where the features of the disposable cartridge are stored, in particular the features of the (liquid or solid) active substance that is heated in order to release the vapors to be inhaled; in this way, the re-usable part of the electronic cigarette can read the features of the disposable cartridge coupled thereto, accordingly adjusting the heating to the features of the disposable cartridge.

In most applications, the transponder comprises one single wound antenna (namely, one single coil serving as antenna); however, in some applications, the transponder can comprise a plurality of wound antennas (namely, a plurality of coils serving as antennas), which have different spatial orientations so as to make sure that the transponder is capable of effectively communicating in all possible positions.

A significant problem arising when manufacturing a wound antenna (namely, a coil serving as antenna) for a transponder lies in the need to use a very thin wire (having a diameter in the range of 50-200 microns), hence having an extremely small mechanical resistance (the tensile strength amounts to a few Newtons): if, during the winding of the wire, there accidentally is an even small increase in traction (2-3 excess Newtons are enough), the wire risks breaking, thus consequently leading to a standstill of the automatic machine until the intervention of a skilled operator (who, anyway, needs several minutes to restore the continuity of the wire). Every standstill of the automatic machine obviously reduces the daily productivity of the automatic machine to a significant extent and, at the same time, increases direct costs for the management of the automatic machine, as a consequence of the costs arising from the intervention of the skilled operator.

Patent application GB1590920A discloses a method to manufacture one single coil around an article, comprising the steps of: moving, by means of a main conveyor and along a processing path, a plurality of carriages, each provided with at least one seat designed to house an article; placing, in an input station arranged along the processing path, each article in the seat of a corresponding carriage; and coupling, in a first winding station or, alternatively, in a second winding station arranged one after the other along the path, a wire around an article carried by a carriage so as to create a corresponding coil.

DESCRIPTION OF THE INVENTION

The object of the invention is to provide a method and a machine to manufacture one or more coils around respective articles, said method and said machine allowing a high productivity (measured as number of articles produced per time unit) to be reached and maintained, even in the long run.

According to the invention there are provided a method and a machine to manufacture one or more coils around respective articles as claimed in the appended claims.

The appended claims describe preferred embodiments of the invention and form an integral part of the description.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described with reference to the accompanying drawings showing a non-limiting embodiment thereof, wherein:

FIGS. **1** and **2** are two different perspective views of a component of a disposable cartridge of an electronic cigarette;

FIG. **3** is a schematic front view of a machine producing the component of FIGS. **1** and **2** and manufactured according to the invention;

FIG. **4** is a perspective view, with parts removed for greater clarity, of the machine of FIG. **3**;

FIG. **5** is a perspective view of a carriage of a main conveyor of the machine of FIG. **3**;

FIG. **6** is a perspective view, with parts removed for greater clarity, of a winding station of the machine of FIG. **3**;

FIG. **7** is a perspective view, with parts removed for greater clarity, of a welding station of the machine of FIG. **3**;

FIG. **8** is a perspective view of a component of a disposable cartridge of an electronic cigarette other than the one of FIGS. **1** and **2**;

FIG. **9** is a schematic view of a machine producing the component of FIG. **8** and manufactured according to the invention; and

FIG. **10** is similar to FIG. **5** but shows the component of the disposable cartridge of the electronic cigarette being changed to a different orientation relative to the carriage via a handling station of the machine of FIG. **3**.

Preferred Embodiments of the Invention

In FIGS. **1** and **2**, reference number **1** indicates, as a whole, an article making up a component of a disposable cartridge of an electronic cigarette.

The article **1** approximately has the shape of a parallelepiped having six walls (faces): an upper wall **2**, a lower wall **3** parallel to and opposite the upper wall **2**, a front wall **4**, a rear wall **5** parallel to and opposite the front wall **4** and two side walls **6** parallel to and opposite one another.

The articles **1** comprises two pins **7** and **8** (namely, two small columns), which project (namely, in a perpendicular manner) from the front wall **4**.

The article **1** comprises a transponder **9**, namely an electronic device (of the passive kind, namely without a power supply of its own), which is capable of storing information and is capable of communicating through radio frequency. In other words, the transponder **9** is a small-sized smart label, which is designed to reply to the interrogation made from a distance by suitable fixed or portable apparatuses, known as readers (or interrogator devices); a reader is capable of reading and/or changing the information contained in the transponder **9** being interrogated by communicating with the transponder **9** through radio frequency. As a consequence, the transponder **9** is part of a wireless reading and/or writing system operating according to the so-called RFID ("Radio-Frequency Identification") technology.

The transponder **9** comprises an integrated electronic circuit **10** (namely, a microchip) provided with a non-volatile memory (typically, an EEPROM or a FRAM) and a coil **11**A, which is connected to the electronic circuit **10**; in particular, the electronic circuit **10** has two electrical contacts **12**, to which two ends of the coil **11**A are welded. The coil **11**A is wound and consists of a plurality of turns of an externally insulated conductor wire **13**; in the embodiment shown in the accompanying figures there are approximately 10-15 turns. The conductor wire **13** is wound around the walls **4**, **5** and **6** of the article **1**, whereas the electronic circuit **10** is arranged in a housing obtained in the lower wall **3** of the article **1**. According to a preferred embodiment, the conductor wire **13** has a diameter ranging from 10 to 500 microns and preferably ranging from 20 to 200 microns (even though, in most applications, the diameter ranges from 25 to 150 microns).

The electronic circuit **10** uses the coil **11**A to communicate, through radio frequency, with other electronic devices located nearby. Alternatively or in addition, the electronic circuit **10** could also use the coil **11**A to generate power (used for its own operation and/or to charge its own electric battery) exploiting an electromagnetic field generated by an electronic device located nearby; namely, the electronic circuit **10** could also use the coil to carry out an inductive (namely contact-less) power charging of its own electric battery. As a consequence, the coil **11**A constitutes an antenna, which can be used to exchange (transmit) information by means of electromagnetic waves (in this case, the antenna is part of a telecommunication device) and/or can be used to exchange power by means of electromagnetic waves (in this case, the antenna is part of a charging device). Namely, the coil **11**A constitutes a wound antenna for electromagnetic interactions, which can be aimed at exchanging (transmitting) information or can be aimed at generating electrical power through electromagnetic induction.

In FIGS. **3** and **4**, reference number **14** indicates, as a whole, an automatic machine to assemble the article **1**.

The automatic machine **14** comprises a support body (namely, a frame), which rests on the ground by means of legs and has, at the front, a vertical wall on which the operating members are mounted. Furthermore, the automatic machine **14** comprises a main conveyor **15**, which moves the articles **1** being processed along an assembling path P, which extends between an input station S**1** (where the main conveyor **15** receives the articles **1** to be completed, namely assembled) and an output station S**2** (where the main conveyor **15** releases complete, namely assembled articles **1**); in particular, the assembling path P is horizontal and linear, namely substantially extends along a straight line arranged horizontally.

The assembling path P goes through a series of stations S**3**-S**7** (better described below), where the articles **1** passing by are subjected to assembling operations.

The main conveyor **15** comprises a plurality of carriages **16**, which are moved along the assembling path P; as better shown in FIG. **5**, each carriage **16** comprises a support plate **17**, where four seats **18** are obtained, each designed to receive and house a corresponding article **1** (namely, each seat **18** reproduces in negative the shape of the article **1** so as to accommodate the article **1** without a significant clearance). The number of seats **18** obtained in the support plate **17** of a carriage **16** could obviously be different from four (it generally ranges from a minimum of one to a maximum to seven-eight seats **18**).

According to FIG. **5**, the main conveyor **15** is normally designed to cyclically move each carriage **16** along the building path P with an intermittent (step-like) movement, which entails cyclically alternating movement phases, in which the main conveyor **15** moves the carriages **16**, and stop phases, in which the main conveyor **15** holds the carriages **16** still. The main conveyor **15** comprises an annular guide **19** (namely, closed on itself with a ring shape), which is arranged in a fixed position along the building path P; in particular, the annular guide **19** consists of one single fixed track (namely, without movement), which is arranged along the building path P. Furthermore, the main conveyor **15** comprises a plurality of slides **20**, each supporting a corresponding carriage **16** and being coupled to the guide **19** so as to freely slide along the guide **19**. Finally, the main conveyor **15** comprises a linear electric motor **21**, which moves the slides **20** carrying the carriages **16** along the building path P; the linear electric motor **16** comprises an annular stator **22** (namely, a fixed primary element), which is arranged in a fixed position along the guide **19**, and a plurality of movable sliders **23** (namely, movable secondary elements), each electrically-magnetically coupled to the stator **22** so as to receive, from the stator **22**, a driving force and rigidly connected to a corresponding slide **20**.

According to a different embodiment, which is not shown herein, the main conveyor **15** is a conveyor belt and comprises (at least) a flexible belt, which supports the carriages **16** and is closed in a ring shape around at least two end pulleys (at least one of them being motor-driven).

According to FIGS. **3** and **4**, at the beginning of the assembling cycle, the main conveyor **15** moves a carriage **16** (carrying four seats **18**) along the assembling path P so as to stop one single carriage **16** in the input station S**1**, where four articles **1** (to be assembled, namely completed) are placed in the corresponding four seats of the carriage **16**.

Subsequently, the main conveyor **15** moves a carriage **16** (carrying four seats **18**) along the assembling path P and from the input station S**1** to the application station S**3** (arranged between the input station S**1** and the feeding station S**4**), where the carriage **16** stops and an adhesive means (for example, one or more glue drops or a double-sided adhesive tape) designed to cause the electronic circuit **10** to stick to the article **1** is applied on each article **1** carried by the carriage **16**. According to a preferred embodiment, in the application station S**3** there are two redundant twin application units, which are used simultaneously or alternatively (so that an application unit can be used, while the other is standing still because it needs to be restored/subjected to maintenance/cleaned).

Subsequently, the main conveyor **15** moves a carriage **16** (carrying four seats **18**) along the assembling path P and from the application station S**3** to the feeding station S**4** (arranged downstream of the input station S**1**), where the carriage **16** stops and each article **1** carried by the carriage **16** is coupled to an electronic circuit **10** provided with the two electrical contacts **12**. According to a preferred embodiment, in the feeding station S**4** there are two redundant twin feeding units, which are used simultaneously or alternatively (so that a feeding unit can be used, while the other is standing still because it needs to be restored/subjected to maintenance/cleaned).

Subsequently, the main conveyor **15** moves a carriage **16** (carrying four seats **18**) along the assembling path P and from the feeding station S**4** to one of the two winding stations S**5** and S**6** (arranged one after the other downstream of the feeding station S**4**), where the carriage **16** stops and an externally insulated conductor wire **13** is wound around each article **1** carried by the carriage **16** in order to create a series of turns making up the wound coil **11**A. According to a preferred embodiment, each winding station S**5** or S**6** is configured to operate with two carriages **16** at a time (namely, with eight articles **1** at a time), since the winding operation is fairly slow (namely, requires time in order to be carried out with a high quality).

As better described below, according to a first embodiment, the two winding stations S**5** and S**6** are redundant twin stations and are used simultaneously (namely, in parallel) or alternatively (so that a winding station S**5** or S**6** can be used, while the other winding station S**6** or S**5** is standing still because it needs to be restored/subjected to maintenance/cleaned). In this case, each carriage **16** is stopped in only one of the two winding stations S**5** or S**6** and, hence, the corresponding coil **11**A is coupled (wound) around each article **1** in the winding station S**5** or, alternatively, in the winding station S**6**; in other words, approximately half the articles **1** receive the corresponding coil **11**A in the winding station S**5**, whereas the remaining half of the articles **1** receive the corresponding coil **11**A in the winding station S**6** and, as a consequence, approximately half the carriages **16** stop in the winding station S**5**, whereas the remaining half of the carriages **16** stops in the winding station S**6** (namely, the two winding stations S**5** and S**6**, by operating together and in parallel, split the carriages **16** between themselves).

According to a second alternative, which is better described below, the two winding stations S**5** and S**6** are used in series one after the other or alternatively to one another (so that a winding station S**5** or S**6** can be used, while the other winding station S**6** or S**5** is standing still because it needs to be restored/subjected to maintenance/cleaned). In this case, each carriage **16** is stopped in both winding stations S**5** or S**6** or is stopped twice in the area of one single winding station S**5** or S**6**.

Subsequently, the main conveyor **15** moves a carriage **16** (carrying four seats **18**) along the assembling path P and from the winding station S**5** and/or S**6** to the welding station S**7** (arranged downstream of the winding stations S**5** and S**6**), where the carriage **16** stops and, in each article **1** carried by the carriage **16**, the two opposite ends of the wound coil **11**A are welded (for example, through ultrasound or through laser) to the two electrical contacts **12** of the electronic circuit **10**. According to a preferred embodiment, the welding station S**7** is configured to operate with four carriages **16** at a time (namely, with sixteen articles **1** at a time), since the welding operation is relatively slow (namely, requires time in order to be carried out with a high quality).

Subsequently, the main conveyor **15** moves a carriage **16** (carrying four seats **18**) along the assembling path P and from the welding station S**7** to the output station S**2** (arranged downstream of the welding station S**7**), where the carriage **16** stops and the articles **1** carried by the carriage **16** are removed from the seats **18** so that they can leave the automatic machine **14**.

According to a preferred embodiment, each seat **18** of a carriage **16** houses the article **1** in a projecting manner so that the article **1** partially protrudes out of the carriage **16** letting a part of a lower wall **3** of the article **1** (where the electronic circuit **10** with the two electrical contacts **12** has to be placed) free. In the application station S**3**, the adhesive means is coupled to the free part of the lower wall **3** of the article **1** from the bottom to the top; if necessary, in the application station S**3** there is a countering body **24** (shown in FIG. **4**), which is vertically movable and (slightly) presses against the articles **1** carried by a carriage **16** from the top to the bottom so as to counter the bottom-to-top thrust applied to the articles **1** during the application of the adhesive means. In the feeding station S**4**, each electronic circuit **10** is coupled to the free part of the lower wall **3** of the article **1** from the bottom to the top; in the feeding station S**4** there preferably is a countering body **25** (shown in FIG. **4**), which is vertically movable and (slightly) presses against the articles **1** carried by a carriage **16** from the top to the bottom so as to counter the bottom-to-top thrust applied to the articles **1** during the feeding of the electronic circuits **10**.

As mentioned above, each winding station S**5**, S**6** is preferably configured to operate with two carriages **16** at a time (namely, with eight articles **1** at a time), hence, in the winding station S**5**, S**6**, eight coils **11**A are simultaneously manufactured by winding eight wires **13** around eight articles **1**. As shown in FIG. **6**, each winding station S**5** or S**6** can comprise eight different positions **26**, each assigned to a corresponding article **1** and allowing the respective wire **13** to be wound around the corresponding article **1**; as a consequence, each winding station S**5**, S**6** operates in parallel carrying our eight different winding operations at a time. According to other embodiments which are not shown herein, the number of positions **26** present in each winding station S**5**, S**6** is different (generally ranging from a minimum of one to a maximum of twelve-sixteen).

Each position **26** of the winding station S**5**, S**6** comprises a movable finger **27**, which is used to move the wire **13**, namely to move the wire **13** towards the article **1**, around the article **1** and, then, away from the article **1**. In particular, each coil **11**A is obtained by directly winding the wire **13** around the article **1**, having a finger **27** revolve around the article **1** with a helical (spiral) rotation movement. In other words, each coil **11**A is directly manufactured around the article **1** by having the movable finger **27**, which engages the wire **13** in a sliding manner, revolve several times around the article **1** with a helical rotation. Each movable finger **27** has a tubular shape having a central hole going through the movable finger **27** from side to side and accommodating the wire **13**; namely, the wire **13** is inserted into a rear opening of the movable finger **27** and comes out from a front opening of the movable finger **27**. For each movable finger **27**, the wire **13** is progressively unwound from a reel contained in a suitable container, goes through a stretching device and, then, reaches the movable finger **27**; each stretching device is configured to apply an always constant stretch to the wire **13**.

Each winding unit S5, S6 comprises a common support body **28** (shown in FIG. **4**), on which all eight movable fingers **27** are mounted in order to move all eight movable fingers **27** always together and with the same identical law of motion; in particular, the eight movable fingers **27** are mounted on the support body **28** in a rigid manner, namely the eight movable fingers **27** always move with the support body **28** in an integral manner and never make any kind of movement relative to the support body **28**. The support body **28** is moved by one single actuator device **29** (shown in FIG. **4**) provided with (at least) an independent electric motor of its own.

According to FIG. **7**, the welding station S7 comprises four welding heads **30**, each arranged in a fixed position and configured to weld the two opposite ends of the wound coil **11**A to the two electrical contacts **12** of the electronic circuit **10**; in use, the main conveyor **15** moves a carriage **16** so as to cause all four articles **1** carried by the carriage **16** to reach, one after the other, the area of a corresponding welding head **42**.

Each welding head **42** also is preferably configured to cut the two opposite ends of the wound coil **11**A downstream of the welds to the two electrical contacts **12** of the electronic circuit **10**, so as to remove the excess part of the two opposite ends of the wound coil **11**A.

The automatic machine **14** comprises a control unit **31** (schematically shown in FIG. **3**), which controls the operation of the entire automatic machine **14**.

The operation of the automatic machine **14** will be described below, with special reference to the peculiar control modes of the winding stations S5 and S6.

The control unit **31** cyclically and continuously monitors the functionality of all components of the automatic machine **14** and, in particular, the functionality of the two winding stations S5 and S6 (which are the components of the automatic machine **14** most frequently subjected to problems) in order to determine whether the winding stations S5 and S6 are capable of operating or not; in particular, the main drawback (problem) that can arise in a winding station S5 or S6 is the breaking of the wire **13** in (at least) a position **26**, since, in case the wire **13** breaks in a position **26**, the position **26** can no longer be used until the continuity of the wire **13** is restored. One of the main indicators that can be used to diagnose the breaking of a wire **13** is the extent of the stretch of the wire **13**: when the stretch of a wire **13** is zero (namely, is below a minimum threshold), the breaking of the wire **13** is basically certain.

As mentioned above, each winding station S5, S6 has a plurality of (in particular, eight) positions **26**, which operate in parallel; hence, if (at least) one of the work positions **26** is not operating, namely is standing still (for example due to the breaking of the wire **13** or because of a scheduled or non-scheduled maintenance intervention), the winding station S5, S6 could continue operating using the sole positions **26** still working (namely, excluding the non-working position **26**); obviously, the seat **18** of a carriage **16** standing in the area of a non-working position **26** has to be left out of production by not feeding a corresponding article **1** in the input station S1, by not applying the adhesive in the application station S3, by not feeding a corresponding electronic circuit **10** in the feeding station S4 and by not carrying out the welding operation in the welding station S7.

However, using a winding station S5 or S6 with one (or more) non-working positions **26** is a makeshift solution, which is generally used by the control unit **31** of the automatic machine **14** only when necessary and only for relatively "short" amounts of time, since it is anyway a solution that jeopardizes productivity (using only seven positions **26** instead of all eight positions **26** reduces productivity by 12.5%) and stresses the entire automatic machine **14** (since it cyclically has to disable, for a work cycle, all parts of the automatic machine **14** involved in the processing of an article **1** that would be assigned to the non-working position **26**).

According to the first embodiment of the invention, when both winding stations S5 and S6 are (fully) operating (namely, when, in both winding stations S5 and S6, all the corresponding positions **26** are working), the preferred operating mode chosen by the control unit **31** of the automatic machine **14** entails using the two winding stations S5 and S6 together and in parallel, having each winding station S5 or S6 operate at a production speed (measured as number of pieces processed per time unit by the station S5 or S6) which is equal to half the production speed (measured as number of pieces processed per time unit) of the automatic machine **14**. In other words, the control unit **31** uses, when they are both (fully) operating, the two winding stations S5 and S6 together and in parallel, having each winding station S5, S6 operate at half the production speed (measured as number of pieces processed per time unit) of the automatic machine **14**, so that half the coils **11**A are manufactured by the winding station S5 and the other half of the coils **11**A is manufactured by the winding station S6.

By way of example, if, at a given time, the production speed of the automatic machine **14** is 480 articles (pieces) per minute, each winding station S5, S6 is caused to operate at a production speed of 240 articles (pieces) per minute and the sum of the two winding stations S5, S6 fulfils the need of the automatic machine **14**, which, as a whole, operates at 480 articles (pieces) per minute. In other words, the stations S1-S4 and S7 of the automatic machine **14** have to each operate at 480 articles (pieces) per minute, whereas the winding stations S5, S6 of the automatic machine **14** have to each operate at 240 articles (pieces) per minute, since there are two of them performing the same task and, hence, splitting the coils **11**A to be manufactured into two halves. It should be pointed out that, when a winding station S5, S6 operates at 240 articles (pieces) per minute, each position **26** of the winding station S5, S6 operates at 30 articles (pieces) per minute (since in each winding station S5 or S6 there are eight positions **26**).

According to this first embodiment, when one of the winding stations S5 and S6 is not (fully) operating (namely, when in one of the winding stations S5 and S6 there is at least one non-working position **26** or when one of the winding stations S5 and S6 is completely not working, for example due to a scheduled or non-scheduled maintenance intervention), the preferred operating mode chosen by the control unit **31** of the automatic machine **14** entails using only the other working winding station S6 or S5, which is caused to operate at a production speed (measured as number of pieces processed per time unit by the station S5 or S6) which is equal to a production speed (measured as number of pieces processed per time unit) of the automatic machine **14**. In other words, the control unit **31** uses, when a winding station S5 or S6 is not (entirely) operating, only the other operating winding station S6 or S5, which is caused to operate at a production speed (measured as number of pieces processed per time unit) which is equal to the production speed of the automatic machine **14** (measured as number of pieces processed per time unit), so that all coils **11**A are manufactured in the only operating winding station S6 or S5.

By way of example, if, at a given time, the production speed of the automatic machine **14** is 480 articles (pieces) per minute, the sole winding station S**5**, S**6** being used is caused to operate at a production speed of 480 articles (pieces) per minute, just like the other stations S**1**-S**4** and S**7** of the automatic machine **14** have to each operate at 480 articles (pieces) per minute.

According to a preferred embodiment, each winding station S**5**, S**6** is capable of operating at a nominal production speed (namely, a maximum production speed measured as number of pieces processed per time unit) which is higher than half a nominal production speed (namely, a maximum production speed measured as number of pieces processed per time unit) of the automatic machine **14** and, in particular, each winding station S**5** or S**6** is capable of operating at a nominal production speed (namely, a maximum production speed measured as number of pieces processed per time unit) which is equal to a nominal production speed (namely, a maximum production speed measured as number of pieces processed per time unit) of the automatic machine **14**. Namely, each winding station S**5**, S**6** is capable of reaching a nominal production speed (namely, a maximum production speed measured as number of pieces processed per time unit) which is equal to a nominal production speed (namely, a maximum production speed measured as number of pieces processed per time unit) of the automatic machine **14** and, hence, each winding station S**5** or S**6** is capable, alone (i.e. without any help from the other winding station S**6** or S**5**), of fulfilling the production needs of the automatic machine **14**, even when the automatic machine **14** reaches its nominal production speed (namely, a maximum production speed measured as number of pieces processed per time unit). Therefore, the two winding stations S**5** and S**6** are completely redundant relative to one another, since there are to winding stations S**5** and S**6** dedicated to the same identical function and each capable of fulfilling, alone, the production needs of the automatic machine **14**, even when the automatic machine **14** reaches its nominal production speed (namely, a maximum production speed measured as number of pieces processed per time unit); hence, the two winding stations S**5** and S**6** are organized so that a problem affecting only one of them cannot determine a general malfunction of the entire automatic machine **14** (even when the automatic machine **14** reaches its nominal production speed).

Always using both winding stations S**5** and S**6** (obviously, when they are both working) allows each winding station S**5** or S**6** to operate at an actual production speed (measured as number of pieces processed per time unit) which, worst case scenario, is half its own nominal production speed (namely, maximum production speed measured as number of pieces processed per time unit). Hence, always using both winding stations S**5** and S**6** (obviously, when they are both working) allows each winding station S**5** or S**6** to operate in a very slow manner (compared to what could be reached by operating at its own nominal production speed) and, therefore, significantly reduces those accelerations (namely, forces) to which all materials (and, especially, the wire **13**) are subjected during the winding, thus significantly reducing the risk of undesired breaking of the wire **13**.

In other words, using both winding stations S**5** and S**6** (obviously, when they are both working) at a "half speed" rather than one single winding station S**5** or S**6** at a "full speed" does not affect the overall productivity of the two winding stations S**5** and S**6** (in any case, the number of pieces produced per time unit is the same), but, on the contrary, it very positively affects the risk of undesired breaking of the wire **13**, namely significantly reduces the risk of undesired breaking of the wore **13**. Therefore, the control unit **31** always prefers the operating mode in which both winding stations S**5** and S**6** (obviously, when they are both working) are used at a "half speed" rather than the operating mode in which one single winding station S**5** or S**6** is used at a "full speed".

As a consequence, when they are both working, the two winding stations S**5** and S**6** are used together and in parallel having each winding station S**5**, S**6** operate at an actual production speed (measured as number of pieces processed per time unit) which always is smaller than its own nominal production speed (namely, maximum production speed measured as number of pieces processed per time unit), even when the automatic machine **14** operates at its own nominal production speed (namely, maximum production speed measured as number of pieces processed per time unit). Furthermore, each winding station S**5** or S**6** is caused to operate at its own nominal production speed (namely, maximum production speed measured as number of pieces processed per time unit) only when it is the only working winding station S**5** or S**6**, for the other winding station S**6** or S**5** is not working.

When, in a winding station S**5** or S**6**, a wire **13** breaks, the control unit **31** can decide not to use the winding station S**5** or S**6** not (completely) operating and, hence, to only use the other winding station S**6** or S**5** completely operating (at twice the speed than before). However, the control unit **31** can also decide to continue using both winding stations S**5** and S**6**, accepting that the winding station S**5** or S**6** not (completely) working operates without the position **26** where the wire **13** broke and, hence, operates with a reduced productivity; this choice is made because giving up a moderate amount of product ivy, having both winding stations S**5** and S**6** operate at a "half speed", could be better than using one single winding station S**5** or S**6** at a "full speed" (with a greater risk of breaking wires **13** in the sole winding station S**5** or S**6** operating at a "full speed"). In these conditions, the smaller productivity of the winding station S**5** or S**6** not (completely) working (namely, of the winding station S**5** or S**6** with a non-working position **26**) could be balanced by slightly increasing the production speed of the winding station S**5** or S**6** not (completely) working, by slightly increasing the production speed of the completely working winding station S**6** or S**5** or by slightly increasing the production speed of both winding stations S**5** and S**6**; however, it should be pointed out that the control unit **31** is not completely free to have the two winding station S**5** and S**6** operate at any production speed, since the operation of the two winding stations S**5** and S**6** is anyway forced to respect times and synchronisms set by all the other stations S**1**-S**4** and S**7** of the automatic machine **14**.

Generally speaking, the choice made by the control unit **31** can change over time and is based on an analysis (also carried out in a remote manner by the manufacturer of the automatic machine **14**) of historic data, which allows for an identification, in all conditions, of the ideal choice (namely, the choice that does not maximize the instantaneous productivity, but maximizes the average productivity over time).

When, in a winding station S**5** or S**6**, a wire **13** breaks, an operators needs to intervene in order to restore the broken wire **13**; obviously, during the operations carried out to restore a broken wire **13** in a winding station S**5** or S**6**, the winding station S**5** or S**6** needs to be completely still and, therefore, during the operations carried out to restore a broken wire **13** in a winding station S**5** or S**6**, there is no other choice but to only have the other winding station S**6** or S**5** be used by the automatic machine **14** for normal production.

According to a preferred embodiment, each winding station S**5**, S**6** is provided with protection elements PE, which isolate the winding station S**5**, S**6** from all other moving parts of the automatic machine **14** and, hence, allow an operator to act upon the winding station S**5** or S**6** standing still while the rest of the automatic machine **14** is working. By so doing, maintenance operations (such as restoring a broken wire **13**) can be carried out even when the automatic machine **14** is regularly operating. According to a possible embodiment, in each winding station S**5**, S**6**, at least one protection element PE is movable is and moved (typically, by a servomotor) between a deactivated position, which does not (mechanically, physically) isolate the corresponding winding station S**5** or S**6** and is assumed only when the corresponding winding station S**5** or S**6** is working, and an active position, which (mechanically, physically) isolates the corresponding winding station S**5** or S**6** and is assumed only when the corresponding winding station S**5** or S**6** is not working, namely is standing still, and has to be subjected to a maintenance intervention by an operator.

In the preferred embodiment described above, each winding station S**5**, S**6** is capable of operating at a nominal production speed (namely, a maximum speed measured as number of pieces processed per time unit) which is equal to a nominal production speed of the automatic machine **14** (measured as number of pieces processed per time unit). According to a different embodiment, each winding station S**5**, S**6** is capable of operating (namely, is configured to operate) at a nominal production speed (namely, a maximum speed measured as number of pieces processed per time unit) which ranges from 30% to 120%, preferably from 50% to 120% of the nominal production speed of the automatic machine **14** (measured as number of pieces processed per time unit). For example, each winding station S**5** or S**6** is capable of operating at a nominal production speed (namely, a maximum speed measured as number of pieces processed per time unit) which is equal to 75% of the nominal production speed of the automatic machine **14** (measured as number of pieces processed per time unit); this embodiment is a compromise between cost needs (the higher the nominal production speed of a winding station S**5** or S**6**, the higher the cost of the winding station S**5** or S**6**) and the need to maintain a high productivity in the long run (when a winding station S**5** or S**6** is not working, the automatic machine **14** cannot reach its nominal production speed, but, on the other hand, a winding station S**5** or S**6** is completely out of order only for a limited amount of time compared to the possible twenty-four hours of continuous operation of the automatic machine **14**).

In the non-limiting embodiment shown in the accompanying figures, the automatic machine **14** comprises two redundant winding stations S**5** and S**6**, which normally operate in parallel at a "half speed" and, only when one single winding station S**5** or S**6** is not working (and, hence, stands still), the other winding station S**5** or S**6** operates alone at a "full speed". According to other embodiments, the automatic machine **14** comprises N redundant winding stations (wherein N is an integer number greater than two, for example three four or five), which normally operate in parallel, each at a production speed that is an N-th of the production speed of the automatic machine **14**; when a winding station stops working, the other winding stations still working increase their production speed accordingly. For example, in case of three winding stations, each winding station has a production speed equal to 33% of the production speed of the automatic machine **14** when all three winding stations are working, each working winding station has a production speed equal to 50% of the production speed of the automatic machine **14** when only two winding stations are working, and the sole remaining winding station has a production speed equal to 100% of the production speed of the automatic machine **14** when one single winding station is working.

To sum up, the control unit **31** is configured to use, when they are both working, the two winding stations S**5** and S**6** together and in parallel, having each winding station S**5** and S**6** operate at a corresponding first production speed, and to use, when a winding station S**5** or S**6** is not working, only the other winding station S**6** or S**5**, which is caused to operate at a second production speed, which is higher than the corresponding first production speed (assuming that the operating speed of the automatic machine **14** remains the same), so as to at least partially make up for the lack of operation of a winding station S**5** or S**6**. Namely, the sum of the first production speeds (of both winding stations S**5** and S**6** working in parallel) is equal to a production speed of the automatic machine **14** and the second production speed (of the sole working winding station S**5** or S**6**) is equal to the production speed of the automatic machine **14**. Each winding station S**5** and S**6** has a nominal production speed which is higher than a nominal production speed of the automatic machine **14** divided by the total number of winding stations S**5** and S**6** and, preferably, each winding station S**5** and S**6** has a nominal production speed which is equal to a nominal production speed of the automatic machine **14**.

More in general, when they all work, all winding stations S**5** and S**6** are used together and in parallel, having each winding station S**5** and S**6** operate at the first speed, so that the sum of all first production speeds is equal to a production speed of the automatic machine **14**; on the other hand, when a winding station S**5** or S**6** is not working, only the other working stations S**6** or S**5** are used, each of them being caused to operate at the second production speed, so that the sum of all second production speeds is equal to a production speed of the automatic machine **14**. Furthermore, each winding station S**5** and S**6** has a nominal production speed which is higher than a nominal production speed of the automatic machine **14** divided by the total number of winding stations S**5** and S**6**.

As mentioned above, the coupling of a wire **13** to an article **1** carried by the respective carriage **16** can take place in only one of the two winding stations S**5** or S**6** operating in parallel (namely, in case one single coil **11**A has to be manufactured around the article **1**) or, according to a second embodiment, in both winding stations S**5** and S**6** (namely, in case at least one of first coil **11**A and one second coil **11**B have to be manufactured around the article **1**).

In the second embodiment, the carriage **16** stops in both stations S**5** and S**6**, if they are both working; in this case, if they are both working, the winding stations S**5** and S**6** operate in series and are arranged consecutive to one another along the processing path P. In this case, when a winding station S**5**, S**6** is not working, the other winding station S**6**, S**5** is configured to couple the wire **13** around the article **1** carried by the carriage **16** in order to manufacture both the corresponding first coil **11**A and the corresponding second coil **11**B, thus serving as the non-working winding station S**5**, S**6** (namely, replacing the non-working winding station S**5**, S**6**). The first coil **11**A and the second coil **11**B are manufactured in two different position of the article **1**, for example in the area of two different walls **2**, **3**, **4**, **5**, **6** (faces) of the article **1** (see FIGS. **3**, **4**, by way of example).

Therefore, in this case, if they are both (fully) working, the winding stations S**5** and S**6** each operate at a first production speed which is equal to the production speed of the automatic machine **14**.

In this case, each winding station S**5**, S**6** is capable of operating (namely, is configured to operate) at a nominal production speed which is even higher than the nominal production speed of the automatic machine **14**, for example is capable of operating a nominal production speed ranging from 100% to 180% of the nominal production speed of the automatic machine **14** (measured as number of pieces processed per time unit). Hence, if one of the two winding stations S**5** or S**6** is not working, the working winding station S**6**, S**5** can increase the relative nominal speed so as to at least partially make up for the lack of operation of the other winding station S**5**, S**6**.

According to the embodiment described above, there can be provided the further step of changing the orientation of the article **1** relative to the carriage **16** in a handling station S**8** (shown in FIG. **9**) arranged along the processing path between the winding station S**5** and the winding station S**6**, preferably downstream of a welding station S**7**. In case a winding station S**5**, S**6** is not working, the carriage **16** can be moved to the working winding station S**5**, S**6** in order to manufacture the first coil **11**A; then, after having manufactured the first coil **11**A, the carriage **16** can be moved from the winding station S**5**, S**6** to the handling station S**8** in order to change the orientation of the article **1** relative to the carriage **16** (as shown in FIG. **10**). After having changed the orientation, the carriage **16** can be moved back from the handling station S**8** to the working winding station S**5**, S**6** in order to create the second coil **11**B.

In this case, the carriage **16** can comprise at least two different seats **18** beside one another, each designed to accommodate the article **1** with a different orientation. In the handling station S**8**, the component can preferably be rotated by 90° (shown in dashed lines in FIG. **10**) or 180°. Furthermore, in the handling station S**8**, the component can be moved form a first seat to a second seat of the carriage **16**.

The two embodiments, namely the first and the second embodiments, described in detail above are two alternative solutions to the same technical problem and are each suited for a particular layout of the automatic machine (namely, one with the two stations S**5**, S**6** configured to operate in parallel and the other with the two stations S**5**, S**6** configured to operate in series).

FIG. **8** shows an article **1** where there are six coils **11**A-**11**F, one for each wall of the article **1**. Therefore, in this case, the conductor wire **13** is wound around all walls of the article **1**, whereas the electronic circuit can be integrated inside the article **1** and, hence, is not visible in FIG. **8**.

FIG. **9** shows a machine **14** to manufacture the article **1** of FIG. **8**, according to the second embodiment described above. Compared to FIG. **3**, there are not the application station S3 and the feeding station S**4** (since, as mentioned above, said circuit can be integrated in the article **1**) and there is the handling station S**8** between the two winding stations S**5**, S**6** downstream of the welding station S**7**. Since the article **1** of FIG. **8** comprises six coils **11**A-**11**F, FIG. **9** shows six winding stations S**5**, S**6** spaced apart from one another by respective welding and handling stations S**7**, S**8**.

In the embodiment shown in the accompanying figures, the wire **13** is an electrically conductor wire, is externally insulated and is wound so as to form a coil **11**A, **11**B, which creates a wound antenna for electromagnetic interactions that can be aimed at exchanging (transmitting) information or can be aimed at generating power through electromagnetic induction. According to a different embodiment, the wire **13** is an electrically conductor wire (and, hence, an electric current can flow through it, even though it has a low or very low intensity), but has a textile core (for example, made of cotton), which is caused to become a conductor, for instance through a doping with metal nanoparticles. According to a further embodiment, the wire **13** is not an electrically conductor wire, is of the textile kind and the coil **11**A, **11**B creates a wick (or the like) for an electronic cigarette.

The embodiments described herein can be combined with one another, without for this reason going beyond the scope of protection of the invention.

In the non-limiting embodiment described above, the article **1** is part of a disposable cartridge of an electronic cigarette, but the method to manufacture the coil **11**A, **11**B, **11**C, **11**D, **11**E, **11**F described above can also be applied to the production of articles of any kind (namely, of any product class). For example, the method to manufacture the coil **11**A, **11**B, **11**C, **11**D, **11**E, **11**F described above can be applied to the production of articles for a machine, a plant, a construction, a product (for example, a payment means) for instance, but not exclusively, of the tobacco, pharmaceutical, food-related or entertainment industry; more in general, the method to manufacture the coil **11**A, **11**B, **11**C, **11**D, **11**E, **11**F described above can be applied to the production of articles for applications of any type.

The embodiments described herein can be combined with one another, without for this reason going beyond the scope of protection of the invention.

The method to manufacture the coil **11**A, **11**B, **11**C, **11**D, **11**E, **11**F described above has many advantages.

First of all, the method to manufacture the coil **11**A, **11**B, **11**C, **11**D, **11**E, **11**F described above reaches and maintains a high productivity (measured as number of articles produced per time unit) even in the long run.

The method to manufacture the coil **11**A, **11**B, **11**C, **11**D, **11**E, **11**F described above operates at a high production speed (measured as number of articles produced per time unit).

The method to manufacture the coil **11**A, **11**B, **11**C, **11**D, **11**E, **11**F described above maintains a high productive quality (generally measured as percentage of faulty articles).

The method to manufacture the coil **11**A, **11**B, **11**C, **11**D, **11**E, **11**F described above is relatively simple and economic to be implemented.

The method to manufacture the coil **11**A, **11**B, **11**C, **11**D, **11**E, **11**F described above prevents the wire **13** from frequently breaking during the winding of the wire **13**.

LIST OF THE REFERENCE NUMBERS OF THE FIGS

1 article
2 upper wall
3 lower wall
4 front wall
5 rear wall
6 side walls
7 pin
8 pin
9 transponder
10 electronic circuit
11A-**11**F coil
12 electrical contacts
13 wire

14 automatic machine
15 main conveyor
16 carriages
17 support plate
18 seats
19 annular guide
20 slides
21 linear electric motor
22 annular stator
23 movable slider
24 countering body
25 countering body
26 positions
27 movable finger
28 support body
29 actuator device
30 welding heads
31 control unit
P building path
S1 input station
S2 output station
S3 application station
S4 feeding station
S5 winding station
S6 winding station
S7 welding station
S8 handling station

The invention claimed is:

1. A method to manufacture one or more coils (**11**A, **11**B, **11**C, **11**D, **11**E, **11**F) around respective articles (**1**) using an automatic machine (**14**) and comprising the steps of:
- moving, by means of a main conveyor (**19**) and along a processing path (P), a plurality of carriages (**16**), each provided with at least one seat (**18**) designed to house an article (**1**);
- placing, in an input station (S**1**) arranged along the processing path (P), each article (**1**) in the at least one seat (**18**) of a corresponding carriage (**16**);
- coupling, in at least one of two winding stations (S**5**, S**6**) arranged one after the other along the path (P), a wire (**13**) around an article (**1**) carried by a carriage (**16**) so as to create a corresponding coil (**11**A, **11**B, **11**C, **11**D, **11**E, **11**F);
- using, when they are both working, the two winding stations (S**5**, S**6**) together and in parallel, having each winding station (S**5**, S**6**) operate at a corresponding first production speed; and
- using, when a winding station (S**5**, S**6**) is not working, only the other winding station (S**6**, S**5**), which is caused to operate at a second production speed, which is higher than the corresponding first production speed.

2. The method according to claim **1**, wherein the sum of the first production speeds is equal to a production speed of the automatic machine (**14**) and the second production speed is equal to the production speed of the automatic machine (**14**).

3. The method according to claim **1**, wherein each winding station (S**5**, S**6**) has a maximum production speed which is higher than a maximum production speed of the automatic machine (**14**) divided by the total number of winding stations (S**5**, S**6**).

4. The method according to claim **1**, wherein each winding station (S**5**, S**6**) has a maximum production speed which is equal to a maximum production speed of the automatic machine (**14**).

5. The method according to claim **1**, wherein, when they are both working, the two winding stations (S**5**, S**6**) are used together and in parallel, having each winding station (S**5**, S**6**) operate at a production speed which always is lower than its own maximum production speed, even when the automatic machine (**14**) operates at its maximum production speed.

6. The method according to claim **1**, wherein each winding station (S**5**, S**6**) is caused to operate at its own maximum production speed only when it is the only working winding station (S**5**, S**6**).

7. The method according to claim **1**, wherein each winding station (S**5**, S**6**) is provided with protection elements, which isolate the winding station (S**5**, S**6**) from all other moving parts of the automatic machine (**14**).

8. The method according to claim **7**, wherein at least one protection element is movable and is moved between a deactivated position, which does not isolate the corresponding winding station (S**5**, S**6**) and is assumed only when the corresponding winding station (S**5**, S**6**) is working, and an active position, which isolates the corresponding winding station (S**5**, S**6**) and is assumed only when the corresponding winding station (S**5**, S**6**) is not working.

9. The method according to claim **1**, wherein each carriage (**16**) is caused to stop in the at least one of two winding stations (S**5**, S**6**) for an amount of time needed to couple the wire (**13**) around a corresponding article (**1**) carried by a carriage (**16**).

10. The method is according to claim **1**, wherein the wire (**13**) is directly wound around each article (**1**) by a movable finger (**27**) that slidably engages the wire (**13**).

11. The method according to claim **1** and comprising the further step of welding, in a welding station (S**7**) arranged along the processing path (P) downstream of the winding stations (S**5**, S**6**), two ends of each coil (**11**A, **11**B, **11**C, **11**D, **11**E, **11**F) to two electrical contacts (**12**) present in the article (**1**).

12. The method according to claim **1**, wherein each winding station (S**5**, S**6**) operates in parallel, coupling, at the same time, several coils (**11**A, **11**B, **11**C, **11**D, **11**E, **11**F) around respective articles (**1**) carried by one or more carriages (**16**).

13. The method according to claim **1**, wherein the main conveyor (**15**) comprises:
- an annular guide (**19**);
- a slide (**20**), which is coupled to the annular guide (**19**) so as to freely slide along the annular guide (**19**) and supports the carriage (**15**); and
- a linear electric motor (**21**), which moves the slide (**20**) and is provided with an annular stator (**22**), which is arranged in a fixed position along the annular guide (**19**), and with a movable slider (**23**), which is electromagnetically coupled to the annular stator (**22**) so as to receive, from the annular stator (**22**), a driving force and is rigidly connected to the slide (**20**).

14. A method to manufacture at least two different coils (**11**A, **11**B, **11**C, **11**D, **11**E, **11**F) around respective articles (**1**) using an automatic machine (**14**); the method comprises the steps of:
- moving, by means of a main conveyor (**19**) and along a processing path (P), a plurality of carriages (**16**), each provided with at least one seat (**18**) designed to house an article (**1**);
- placing, in an input station (S**1**) arranged along the processing path (P), each article (**1**) in the at least one seat (**18**) of a corresponding carriage (**16**);

coupling, in a first winding station (S**5**) arranged along the processing path (P), a wire (**13**) around each article (**1**) carried by a carriage (**16**) so as to create a corresponding first coil (**11**A);

coupling, in a second winding station (S**6**) arranged along the processing path (P) downstream of the first winding station (S**5**), a wire (**13**) around each article (**1**) carried by a carriage (**16**) so as to create a corresponding second coil (**11**B); and

changing the orientation of the article (**1**) relative to the carriage (**16**) in a handling station (S**8**) arranged along the processing path (P) between the first winding station (S**5**) and the second winding station (S**6**);

wherein, in case a winding station (S**5**, S**6**) does not work, the other winding station (S**6**, S**5**) is configured to couple a wire (**13**) around each article (**1**) carried by [a] the carriage (**16**) so as to create both a corresponding first coil (**11**A) and a corresponding second coil (**11**B), taking the place of the winding station (S**5**, S**6**) that is not working.

15. The method according to claim **14** and comprising, in case a winding station (S**5**, S**6**) does not work, the further steps of:

moving each carriage (**16**) to the working winding station (S**5**, S**6**) in order to create a coil (**11**A, **11**B, **11**C, **11**D, **11**E, **11**F);

after the creation of a coil (**11**A, **11**B), moving each carriage (**16**) from the working winding station (S**5**, S**6**) to the handling station (S**8**) in order to change the orientation of the article (**1**) relative to the carriage (**16**); and

after having changed the orientation, moving each carriage (**16**) back from the handling station (S**8**) to the working winding station (S**5**, S**6**) in order to create the other coil (**11**A, **11**B).

16. An automatic machine (**14**) to manufacture one or more coils (**11**A, **11**B, **11**C, **11**D, **11**E, **11**F) around respective articles (**1**) and comprising:

a main conveyor (**19**), which is configured to move, along a processing path (P), a plurality of carriages (**16**), each provided with at least one seat (**18**) designed to house an article (**1**);

an input station (S**1**), which is arranged along the processing path (P) and is configured to place each article (**1**) in the at least one seat (**18**) of a corresponding carriage (**16**);

at least one first winding station (S**5**) and at least one second winding station (S**6**), which are arranged one after the other along the path (P) and are each configured to couple a wire (**13**) around an article (**1**) carried by a carriage (**16**) so as to create a corresponding coil (**11**A, **11**B, **11**C, **11**D, **11**E, **11**F); and

a control unit (**31**), which is configured to:

use, when they are both working, the two winding stations (S**5**, S**6**) together and in parallel, having each winding station (S**5**, S**6**) operate at a corresponding first production speed; and

use, when a winding station (S**5**, S**6**) is not working, only the other winding station (S**6**, S**5**), which is caused to operate at a second production speed, which is higher than the corresponding first production speed.

17. An automatic machine (**14**) to manufacture one or more coils (**11**A, **11**B, **11**C, **11**D, **11**E, **11**F) around respective articles (**1**) and comprising:

a main conveyor (**19**), which is configured to move, along a processing path (P), a plurality of carriages (**16**), each provided with at least one seat (**18**) designed to house an article (**1**);

an input station (S**1**), which is arranged along the processing path (P) and is configured to place each article (**1**) in the at least one seat (**18**) of a corresponding carriage (**16**);

at least one first winding station (S**5**) and at least one second winding station (S**7**), which are arranged one after the other along the path (P) and are each configured to couple a wire (**13**) around an article (**1**) carried by a carriage (**16**) so as to create a corresponding coil (**11**A, **11**B, **11**C, **11**D, **11**E, **11**F); and

a control unit (**31**), which is configured to use, when they all work, all winding stations (S**5**, S**6**) together and in parallel, having each winding station (S**5**, S**6**) operate at a first production speed, so that the sum of all first production speeds is equal to a production speed of the automatic machine (**14**);

wherein the control unit (**31**) is configured to use, when a winding station (S**5**, S**6**) does not work, only the other working winding stations (S**5**, S**6**), each of them being caused to operate at a second production speed, so that the sum of all second production speeds is equal to a production speed of the automatic machine (**14**); and

wherein each winding station (S**5**, S**6**) has a maximum production speed which is higher than a maximum production speed of the automatic machine (**14**) divided by the total number of winding stations (S**5**, S**6**).

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