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(54) **CABLE PRODUCTION SYSTEM**

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Description

[TECHNICAL FIELD]

[0001] The present invention relates to an electric wire production system for producing an electric wire for use in a wiring harness and so forth, which is mounted on a motor vehicle and so forth as a mobile unit.

[BACKGROUND ART]

[0002] An electric wire (or merely described as "a wire") is produced being continuously coated with synthetic resin around an outer circumference of its core wire consisting of plurality of element wires. For the sake of productivity, normally, a long electric wire is produced and the number of changing colors is minimized, that is, normally, a long electric wire is produced with the same color. Normally, a long electric wire of a large batch is packaged and shipped to an electric wire distributor and then the electric wire having a color which meets a customer's demand is cut at a storehouse. A wiring harness consisting of electric wires having various colors for use in an electric circuit is employed in household appliances, aircraft and electric machines.

[0003] Various electronic equipment is mounted on a motor vehicle as a mobile unit. Therefore, a motor vehicle is provided with a wiring harness for supplying an electric power from an electric source to electronic equipment and for transferring control signals and so on from a computer to electronic equipment. The wiring harness includes a plurality of electric wires, electric connectors, each being attached to an end of the wire, and so on.

[0004] The wire includes an electrically conductive core wire and an electrically insulating coating which coats the core wire. The wire is so-called a coated wire. The connector includes a terminal fitting and an electrically insulating connector housing. The terminal fitting consists of a conductive sheet metal and so on. The connector housing is formed in a box-shape and receives the terminal fitting. The connector is coupled with a mating connector of electronic equipment, thereby the wiring harness transmits electric power and signals to the electronic equipment.

[0005] As for the electric wires of the wiring harness, a size of the core wire, material of the coating (for the purpose of changing material depending on heat-resisting property), and purpose of use must be distinguished. Here, the purpose of use is, for example, an air bag, antilock brake system (ABS), control signal such as vehicle speed information, and motor vehicle system such as a power transmission system in which the electric wires are used.

[0006] In order to distinguish the purpose of use as described above, the electric wires in the wiring harness are colored with various colors. Upon producing conventional electric wires, when the outer circumference of the core wire is extrusion-coated with insulating synthetic

resin, a coloring agent of a desired color is mixed into the synthetic resin so as to color the coating with the desired color.

[0007] Therefore, in a plant of the electric wire, electric wires having all the colors which a customer needs are produced separately color by color, then cut into a predetermined length, for example, 500 - 2000 m, and then bundled up. When electric wires are being delivered after receiving an order, first according to the order, the necessary amount of bundles consisting of electric wires having the desired color are conveyed from a plant of the electric wire to a distribution center. Then, at the distribution center, the electric wires which are bundled are cut into a predetermined length and then they are delivered to the customer. Alternatively, at the distribution center, the necessary amount of bundles are delivered to the customer.

[0008] In the conventional method of producing an electric wire as described above, the electric wires are cut into a length, for example, 500 - 2000 m and then bundled up. Moreover, in a plant of the electric wire, electric wires having various colors which are considered to meet a customer's demand are produced. Furthermore, at a distribution center, the electric wires which are bundled are cut into a length according to an amount of an order from the customer. Alternatively, at the distribution center, the necessary amount of bundles are delivered to the customer.

[0009] In a case that the necessary amount of bundles are delivered to the customer from the distribution center, the customer is forced to purchase an excess amount of electric wires beyond the necessary amount. Accordingly, when the customer produces a product such as a wiring harness in which the electric wires purchased are used, a cost of such a product possibly might be increased. In a case that the electric wires which are bundled are cut into a length according to an amount of an order from the customer at a distribution center and then delivered to the customer, an excess of the electric wires might remain, possibly with regard to color by color, at the distribution center after the delivery.

[0010] Thus, according to the above-mentioned conventional method of on-demand production of an electric wire, an excess of the electric wires inevitably remains in at least one of the distribution center and the customer, causing a problem from the viewpoint of resource saving.

[0011] Furthermore, in the plant of electric wires, the electric wires are produced separately color by color. Accordingly, in the plant of the electric wires and the distribution center, a very wide space must be secured for storing the electric wires, causing a deterioration in the production efficiency of the wiring harness and therefore, causing an increase in the cost of a product which uses the electric wires, such as a wiring harness. Furthermore, a coloring agent is mixed into the synthetic resin of the coating so as to color the electric wire. Accordingly, it is not easy to change the color of the electric wire in a manufacture line of the wire, thereby sometimes forcing the

manufacture line to produce the electric wires in advance before receiving the order from a customer, causing a problem from the viewpoint of resource saving and an increase in the cost of the electric wires.

[0012] JP 10 031918 A discloses a device for marking a wire according to the preamble of claim 1.

[DISCLOSURE OF THE INVENTION]

[0013] It is therefore an objective of the present invention to solve the above problems and to provide an electric wire production system, by which system a cost of a product which uses electric wires, such as a wiring harness, can be prevented from increasing and resource saving can be achieved.

[0014] The present invention provides an electric wire production system according to claim 1. Further advantageous embodiments of the present invention are disclosed in the dependent claims. In the present invention, on the basis of the electric wire production data inputted to the input department, the production control department forwards the first production data indicating a product number and length of an electric wire to be produced to the production department and the second production data indicating a product number, length, shape of a mark and color of the mark of an electric wire to be produced to the coloring/cutting department. The production department produces a necessary amount of the monochrome wire and conveys it to the coloring/cutting department. Since the production department produces the monochrome wire, the amount of the wire to be stored in advance in the production department can be restricted. Further, since the production department produces the monochrome wire, the amount of the wires having various types of color to be stored in advance in the production department can be restricted, there is no need to change the color and therefore, no need to produce the wire in advance.

[0015] The production department produces a necessary amount (i.e. length) of the monochrome wire. The coloring/cutting department colors the outer circumference of the monochrome wire with a desired color, forms a desired mark, and cuts the wire into a desired length. Therefore, the amount of wire to be temporarily stored between the production department and the coloring/cutting department can be restricted.

[0016] The electric wire production data indicating a product number, length, shape of a mark and color of the mark of the necessary electric wire to be produced are inputted to the input department, then the production department produces the wire and then, the coloring/cutting department colors and cuts the wire. Accordingly, once the electric wire production data are inputted to the input department, the desired wire is speedily produced. A period of time required from order-receiving to shipping after production can be reduced and there is no need to produce the wire in advance.

[0017] In the present invention, after the input to the

input department, the wire produced in the production department is non-colored. Therefore, the non-colored wire can be securely colored with a desired color according to needs. In this specification, "non-colored" means a state in which a coloring agent is not added to the synthetic resin of the coating of the electric wire, that is, "non-colored" means a color of the synthetic resin itself. In this specification, "coloring an electric wire" means coloring an outer surface of the coating of the electric wire with a coloring agent.

[0018] In this specification, the coloring agent means a liquid substance, in which a coloring material (organic substance for use in industry) is dissolved and dispersed in water or other solvent. The organic substance described above is a dye or a pigment (mainly, organic substance and synthetic product). Sometimes, a dye is used as a pigment and a pigment is used as a dye. In this specification, as a substantial example, the coloring agent is a coloring liquid or coating material. The coloring liquid is a liquid, in which a dye is dissolved or dispersed in a solvent. The coating material is a material, in which a pigment is dispersed in a liquid dispersion.

[0019] When the coating of the wire is colored with a coloring liquid, the dye permeates into the coating. When the coating of the wire is colored with a coating material, the pigment adheres to the outer surface without permeating into the coating of the wire. In this specification, "to color the coating" means to dye the outer surface of the coating with a dye or to coat the outer surface of the coating with a pigment. In this specification, "to color the coating" implies the coloring of coating agent itself for protecting the coloring agent as described above or coloring and dyeing the ultraviolet curing resin containing the coloring agent.

[0020] Preferably, the solvent and liquid dispersion have an affinity to the synthetic resin of the coating in order to securely permeate the dye into the coating of the wire or to make the pigment securely adhere to the outer surface of the coating of the wire.

[0021] In the present invention, the coloring/cutting department has a plurality of coloring units. Each coloring unit spouts a specific amount of its own coloring agent of specific color toward the outer surface of the wire. The color of the coloring agent spouted from one coloring unit is different from that of the coloring agent spouted from another coloring unit. Accordingly, a color for coloring the outer surface of the wire can be easily changed by changing the coloring unit.

[0022] The coloring unit spouts a specific amount of the coloring agent toward the outer surface of the wire. Therefore, a shape of a mark to be formed on the outer surface of the wire can be easily changed by changing the spouting amount and spouting time interval of the coloring agent from the coloring unit. Further, since the coloring unit spouts a specific amount of the coloring agent per one operation, enabling to avoid waste of the coloring agent.

[0023] In the present invention, the production depart-

ment forwards the first confirmation data, indicating the monochrome electric wire becoming conveyable, to the production control department and the coloring/cutting department. Therefore, the production control department can grasp a state of progress in the manufacturing process of the wire. The coloring/cutting department can confirm a date when the monochrome wire is conveyed.

[0024] In the present invention, the coloring/cutting department forwards the second confirmation data, indicating a date when the wire colored and cut according to the second production data can be obtained, to the production control department. Accordingly, the production control department can securely grasp a state of progress in the manufacturing process of the wire.

[0025] In the present invention, on the basis of the electric wire production data inputted to the input department, the production control department forwards the first production data indicating a product number and length of an electric wire to be produced to the production department and the second production data indicating a product number, length, shape of a mark and color of the mark of an electric wire to be produced to the coloring department. The production department produces a necessary amount of the monochrome wire and conveys it to the coloring department. Since the production department produces the monochrome wire, the amount of the wire to be stored in advance in the production department can be restricted. Further, since the production department produces the monochrome wire, the amount of the wires having various types of color to be stored in advance in the production department can be restricted, there is no need to change the color and therefore, no need to produce the wire in advance.

[0026] The production department produces a necessary amount (i.e. length) of the monochrome wire. The coloring department colors the outer circumference of the monochrome wire with a desired color and forms a desired mark. Therefore, the amount of wire to be temporarily stored between the production department and the coloring department can be restricted.

[0027] The electric wire production data indicating a product number, length, shape of a mark and color of the mark of the necessary electric wire to be produced are inputted to the input department, then the production department produces the wire and then, the coloring department colors the wire. Accordingly, once the electric wire production data are inputted to the input department, the desired wire is speedily produced. A period of time required from order-receiving to shipping after production can be reduced and there is no need to produce and store the wire in advance.

[0028] In the present invention, after the input to the input department, the wire produced in the production department is non-colored. Therefore, the non-colored wire can be securely colored with a desired color according to needs.

[0029] In the present invention, the coloring department has a plurality of coloring units. Each coloring unit

spouts a specific amount of its own coloring agent of specific color toward the outer surface of the wire. The color of the coloring agent spouted from one coloring unit is different from that of the coloring agent spouted from another coloring unit. Accordingly, a color for coloring the outer surface of the wire can be easily changed by changing the coloring unit.

[0030] The coloring unit spouts a specific amount of the coloring agent toward the outer surface of the wire. Therefore, a shape of a mark to be formed on the outer surface of the wire can be easily changed by changing the spouting amount and spouting time interval of the coloring agent from the coloring unit. Further, since the coloring unit spouts a specific amount of the coloring agent per one operation, enabling to avoid waste of the coloring agent.

[0031] In the present invention, the production department forwards the first confirmation data, indicating the monochrome electric wire becoming conveyable, to the production control department and the coloring department. Therefore, the production control department can grasp a state of progress in the manufacturing process of the wire. The coloring department can confirm a date when the monochrome wire is conveyed.

[0032] In the present invention, the coloring department forwards the second confirmation data, indicating a date when the wire colored and cut according to the second production data can be obtained, to the production control department. Accordingly, the production control department can securely grasp a state of progress in the manufacturing process of the wire.

[BRIEF DESCRIPTION OF THE DRAWINGS]

[0033]

Figure 1 illustrates a basic constitution of an electric wire production system according to a first preferred embodiment of the present invention;

Figure 2 illustrates a basic constitution of a production control department in the electric wire production system shown in Fig. 1;

Figure 3 is a flow chart illustrating a step flow for producing an electric wire in the electric wire production system shown in Fig. 1;

Figure 4 is a perspective view illustrating an example of an electric wire produced in the electric wire production system shown in Fig. 1;

Figure 5 illustrates an example of a production department in the electric wire production system shown in Fig. 1;

Figure 6 is a perspective view illustrating an example of a coloring/cutting department in the electric wire production system shown in Fig. 1;

[0034] In the present invention described in claim 3, the coloring/cutting department has a plurality of coloring units. Each coloring unit spouts a specific amount of its

own coloring agent of specific color toward the outer surface of the wire. The color of the coloring agent spouted from one coloring unit is different from that of the coloring agent spouted from another coloring unit. Accordingly, a color for coloring the outer surface of the wire can be easily changed by changing the coloring unit.

[0035] The coloring unit spouts a specific amount of the coloring agent toward the outer surface of the wire. Therefore, a shape of a mark to be formed on the outer surface of the wire can be easily changed by changing the spouting amount and spouting time interval of the coloring agent from the coloring unit. Further, since the coloring unit spouts a specific amount of the coloring agent per one operation, enabling to avoid waste of the coloring agent.

[0036] In the present invention described in claim 4, the production department forwards the first confirmation data, indicating the monochrome electric wire becoming conveyable, to the production control department and the coloring/cutting department. Therefore, the production control department can grasp a state of progress in the manufacturing process of the wire. The coloring/cutting department can confirm a date when the monochrome wire is conveyed.

[0037] In the present invention described in claim 5, the coloring/cutting department forwards the second confirmation data, indicating a date when the wire colored and cut according to the second production data can be obtained, to the production control department. Accordingly, the production control department can securely grasp a state of progress in the manufacturing process of the wire.

[0038] In the present invention described in claim 6, on the basis of the electric wire production data inputted to the input department, the production control department forwards the first production data indicating a product number and length of an electric wire to be produced to the production department and the second production data indicating a product number, length, shape of a mark and color of the mark of an electric wire to be produced to the coloring department. The production department produces a necessary amount of the monochrome wire and conveys it to the coloring department. Since the production department produces the monochrome wire, the amount of the wire to be stored in advance in the production department can be restricted. Further, since the production department produces the monochrome wire, the amount of the wires having various types of color to be stored in advance in the production department can be restricted, there is no need to change the color and therefore, no need to produce the wire in advance.

[0039] The production department produces a necessary amount (i.e. length) of the monochrome wire. The coloring department colors the outer circumference of the monochrome wire with a desired color and forms a desired mark. Therefore, the amount of wire to be temporarily stored between the production department and the coloring department can be restricted.

[0040] The electric wire production data indicating a product number, length, shape of a mark and color of the mark of the necessary electric wire to be produced are inputted to the input department, then the production department produces the wire and then, the coloring department colors the wire. Accordingly, once the electric wire production data are inputted to the input department, the desired wire is speedily produced. A period of time required from order-receiving to shipping after production can be reduced and there is no need to produce and store the wire in advance.

[0041] In the present invention described in claim 7, after the input to the input department, the wire produced in the production department is non-colored. Therefore, the non-colored wire can be securely colored with a desired color according to needs.

[0042] In the present invention described in claim 8, the coloring department has a plurality of coloring units. Each coloring unit spouts a specific amount of its own coloring agent of specific color toward the outer surface of the wire. The color of the coloring agent spouted from one coloring unit is different from that of the coloring agent spouted from another coloring unit. Accordingly, a color for coloring the outer surface of the wire can be easily changed by changing the coloring unit.

[0043] The coloring unit spouts a specific amount of the coloring agent toward the outer surface of the wire. Therefore, a shape of a mark to be formed on the outer surface of the wire can be easily changed by changing the spouting amount and spouting time interval of the coloring agent from the coloring unit. Further, since the coloring unit spouts a specific amount of the coloring agent per one operation, enabling to avoid waste of the coloring agent.

[0044] In the present invention described in claim 9, the production department forwards the first confirmation data, indicating the monochrome electric wire becoming conveyable, to the production control department and the coloring department. Therefore, the production control department can grasp a state of progress in the manufacturing process of the wire. The coloring department can confirm a date when the monochrome wire is conveyed.

[0045] In the present invention described in claim 10, the coloring department forwards the second confirmation data, indicating a date when the wire colored and cut according to the second production data can be obtained, to the production control department. Accordingly, the production control department can securely grasp a state of progress in the manufacturing process of the wire.

[BRIEF DESCRIPTION OF THE DRAWINGS]

[0046]

Figure 1 illustrates a basic constitution of an electric wire production system according to a first preferred embodiment of the present invention;

Figure 2 illustrates a basic constitution of a production control department in the electric wire production system shown in Fig. 1;

Figure 3 is a flow chart illustrating a step flow for producing an electric wire in the electric wire production system shown in Fig. 1;

Figure 4 is a perspective view illustrating an example of an electric wire produced in the electric wire production system shown in Fig. 1;

Figure 5 illustrates an example of a production department in the electric wire production system shown in Fig. 1;

Figure 6 is a perspective view illustrating an example of a coloring/cutting department in the electric wire production system shown in Fig. 1;

Figure 7 illustrates a constitution of an electric wire coloring unit in the coloring/cutting department shown in Fig. 6;

Figure 8 illustrates a basic constitution of an electric wire production system according to a second preferred embodiment of the present invention;

Figure 9 illustrates a basic constitution of a production control department in the electric wire production system shown in Fig. 8;

Figure 10 is a flow chart illustrating a step flow for producing an electric wire in the electric wire production system shown in Fig. 8;

Figure 11 is a perspective view illustrating an example of a coloring department in the electric wire production system shown in Fig. 8;

Figure 12 illustrates a constitution of an electric wire coloring unit in the coloring department shown in Fig. 11;

Figure 13 illustrates a constitution of another example of a production department and coloring/cutting department in the electric wire production system according to the present invention; and

Figure 14 is a perspective view illustrating another example of an electric wire coloring unit in the electric wire production system according to the present invention.

[BEST MODE FOR CARRING OUT THE INVENTION]

[0047] In the following, an electric wire production system according to a first preferred embodiment of the present invention will be explained with reference to Figs. 1 - 7. An electric wire production system 1 (shown in Fig. 1) according to the first preferred embodiment of the present invention is a system for producing an electric wire 3 shown in Fig. 4.

[0048] The electric wires 3 constitute a wiring harness which is mounted on a machine such as a motor vehicle. As shown in Fig. 4, the electric wire 3 includes an electrically conductive core wire 4 and an electrically insulating coating 5. The core wire 4 is formed by twisting a plurality of element wires together. The element wire is made of conductive metal. The core wire 4 may consist

of a single element wire.

[0049] The coating 5 is made of insulating synthetic resin such as polyvinyl chloride (PVC). The coating 5 coats the core wire 4. That is, an outer surface 5a of the coating 5 is an outer surface of the electric wire 3. The outer surface 5a of the coating 5 has a single color P (hereinafter, called "monochrome P"). The synthetic resin of the coating 5 may be mixed with a desired coloring agent such as a coloring agent of white color so as to color the outer surface 5a of the wire 3 with monochrome P, or alternatively, the synthetic resin of the coating 5 may not be mixed with any coloring agent so as to make the monochrome P be a color of the synthetic resin itself.

[0050] When the synthetic resin of the coating 5 is not mixed with any coloring agent so that the monochrome P is the color of the synthetic resin itself, the outer surface 5a of the coating 5, that is, the outer surface 5a of the wire 3 is called non-coloring. That is, in this specification, "non-coloring" means that no coloring agent is mixed into the synthetic resin of the coating 5 and therefore the outer surface 5a of the wire 3 has a color of the synthetic resin itself.

[0051] On the outer surface 5a of the wire 3, there is formed a mark 8 consisting of a plurality of first points 6 and a plurality of second points 7. The first point 6 has a first color B (shown by parallel diagonal lines in Fig. 4). The first color B is different from the monochrome P. The second point 7 has a second color R (shown by parallel diagonal lines in Fig. 4). The second color R is different from both monochrome P and first color B.

[0052] Each plane shape of the first point 6 and second point 7 is round. There are formed plurality of the first points 6 and second points 7, and they are arranged in the longitudinal direction of the wire 3 according to a predetermined pattern. In an example shown in Fig. 4, in the longitudinal direction of the wire 3, six first points 6 are formed, then four second points 7 are formed and then, six first points 6 are formed.

[0053] The following three distances are predetermined: a distance D1 between the centers of the first points 6 adjacent to each other; a distance D2 between the centers of the second points 7 adjacent to each other; and a distance D3 between the center of the first point 6 and the center of the second point 7 adjacent to each other. Further, a diameter R1 of the first point 6 and a diameter R2 of the second point 7 are predetermined.

[0054] The color B of the first point 6 and color R of the second point 7 mean the color of the mark 8. Thus, the color of the mark 8 denotes the colors B and R of the points 6 and 7, respectively, which constitute the mark 8 formed on the outer surface 5a of the electric wire 3. The distances D1, D2 and D3, the diameters R1 and R2, and the number of the points 6 and points 7 mean the shape of the mark 8. Thus, the shape of the mark 8 denotes the arrangement state of the points 6 and points 7, which form the mark 8.

[0055] As for the electric wire 3, if their product numbers differ, the outer diameters of the core wire 4 (of

course, outer diameters of the coating 5 as well) or the materials of the coating 5 differ. Thus, in this specification, the product number of the electric wire 3 denotes the diameter of the core wire 4, that is, the diameter of the electric wire 3 and the material of the coating 5. Hereinafter, the diameter of the electric wire 3 is called wire diameter. Further, as for the electric wire 3, if the systems in a motor vehicle (such as an antilock brake system, power transmission system and so forth) described above differ, the colors B and R, distances D1, D2 and D3, diameters R1 and R2, and the number of the points 6 and points 7 differ. The electric wires 3 can be distinguished from each other by the colors B and R, distances D1, D2 and D3, diameters R1 and R2, or the number of the points 6 and points 7.

[0056] A plurality of the electric wires 3 are bundled, then a connector or the like is attached to the end of the bundled electric wires 3, thereby forming a wiring harness as described above. The connector is coupled with a mating connector of various electronic equipment in the motor vehicle, thereby the wiring harness, that is, the wires 3 transmit various signals and electric power to the various electronic equipment.

[0057] The colors B and R, distances D1, D2 and D3, diameters R1 and R2, and the number of the points 6 and points 7 described above are used in order to distinguish the types of the electric wire 3 in a wiring harness mounted on a vehicle and the systems in a vehicle, such as a power transmission system and so on, in which the wires 3 are used. That is, the colors B and R, distances D1, D2 and D3, diameters R1 and R2, and the number of the points 6 and points 7 described above indicate the purposes of use of the respective wires 3 in the wiring harness and make the purposes of use distinguishable. Therefore, an electric wire coloring device 26 in a coloring/cutting department 12 (explained later on) marks the wire 3 in order to distinguish the types of the wire 3 and the systems in a vehicle, that is, the purposes of use.

[0058] As shown in Fig. 1, the electric wire production system 1 includes a plurality of input departments 9, a production control department 10, production department 11, and coloring/cutting department 12. As the input department 9, there is, for example, a business department of the wire 3 or the product in which the wires 3 are used (such as a wiring harness), a customer (i.e. order-making side) of the wire 3 or the product in which the wires 3 are used such as a motor vehicle maker, or a production line of the product in which the wires 3 are used (such as a wiring harness).

[0059] The input department 9 includes a portable computer 9a having a known RAM, ROM and CPU. Electric wire production data D, which indicate a product number (wire diameter and material of the coating 5) of necessary wire 3, a length, arrangement state of the points 6 and points 7 to be formed on the outer surface 5a, and the colors B and R of the point 6 and point 7 that constitute the mark 8, are inputted into the portable computer 9a by a person who makes an order of the wire 3.

Upon inputting, an information-inputting device such as a known keyboard and touch panel can be used.

[0060] As the production control department 10, there is, for example, a control department for controlling the business department described above or a control department for controlling a production line of a product in which the wires 3 are used (such as a wiring harness). The production control department 10 includes a portable computer 10a having a known RAM, ROM and CPU. The portable computer 10a of the production control department 10 is linked to the portable computers 9a of the respective input departments 9, the production department 11, and the coloring/cutting department 12 through a network and so on.

[0061] The electric wire production data D is inputted into the portable computer 10a of the production control department 10 from the portable computers 9a of the respective input departments 9. The electric wire production data D indicate a product number of necessary wire 3, a shape of the mark 8, and length of the mark 8 per the colors B and R.

[0062] When the electric wire production data D is inputted from the respective input departments 10, the portable computer 10a makes the production department 11 produce the necessary length of the wire 3 which is monochrome P having a necessary product number. Then, the portable computer 10a makes the coloring/cutting department 12 mark the monochrome wire 3 produced by the production department 11 with a desired shape and the desired colors B and R, and makes the coloring/cutting department 12 cut the wire 3 into a desired length. At this time, the portable computer 10a forwards second confirmation data DK2 (explained later on) inputted from the coloring/cutting department 12 to the respective input departments 9.

[0063] The portable computer 10a of the production control department 10 receives first confirmation data DK1, indicating a date when the produced wire 3, the outer surface 5a of which is monochrome P, is conveyable to the coloring/cutting department 12, from the production department 11. Further, the portable computer 10a of the production control department 10 receives second confirmation data DK2, indicating a date when the coloring/cutting department 12 completes the production of the wire 3, the outer surface 5a of which is marked with a desired shape and desired colors B and R and which is cut into a desired length.

[0064] The portable computer 10a of the production control department 10 is a control system including a sequence for providing necessary information (data DT1 and DT2 explained later on) upon producing the wire 3 to the production department 11 and the coloring/cutting department 12, in response to the electric wire production data D inputted from the respective input departments 9. Sequence that the portable computers 9a and 10a perform may be carried out artificially, or alternatively, by using a device into which mechanical and electrical information is inputted.

[0065] As shown in Fig. 2, the portable computers 10a of the production control department 10 includes a data integration module 13, a module 14 for making first production data, a module 15 for making second production data and so on. The data integration module 13 is linked to the portable computers 9a of the respective input departments 9 through an input/output module 16. The data integration module 13 receives the electric wire production data D from the portable computers 9a of the respective input departments 9.

[0066] The data integration module 13 decodes the electric wire production data D on the basis of a program stored in a database 17. The data integration module 13 integrates the electric wire production data D forwarded from the respective input departments 9 and computes a length of the wire 3 to be produced per a product number, shape of the mark 8, and the colors B and R of the mark 8 so as to make a production data DT. The data integration module 13 forwards the production data DT to both module 14 for making first production data and module 15 for making second production data. The production data DT indicate a length of the wire 3 to be produced per a product number, shape of the mark 8, and the colors B and R of the mark 8.

[0067] The data integration module 13 is linked to the production department 11 and the coloring/cutting department 12 through an input module 18. The data integration module 13 receives the first confirmation data DK1 from the production department 11 and the second confirmation data DK2 from the coloring/cutting department 12. Then, the data integration module 13 forwards the second confirmation data DK2 to the respective input departments 9 through the input/output module 16.

[0068] The module 14 for making first production data decodes the production data DT on the basis of a program stored in a database 17. The module 14 for making first production data computes a length of the wire 3 to be produced per a product number from the production data DT so as to make a first production data DT1. The first production data DT1 indicates the length of the wire 3 to be produced per a product number. The module 14 for making first production data forwards the first production data DT1 to the production department 11 through the output module 19.

[0069] The module 15 for making second production data decodes the production data DT on the basis of a program stored in a database 17. The module 15 for making second production data computes a length of the wire 3 to be produced per a product number, shape of the mark 8 and the colors B and R of the mark 8 from the production data DT so as to make a second production data DT2. The second production data DT2 indicates the length of the wire 3 to be produced per a product number, shape of the mark 8 and the colors B and R of the mark 8. The module 15 for making second production data forwards the second production data DT2 to the coloring/cutting department 12 through the output module 19.

[0070] As the production department 11, there is, for

example, an electric wire production line in an electric wire plant. As shown in Fig. 5, the production department 11 includes a supply unit 20, extrusion-coating unit 21, cooling water bath 22, and winding unit 23. Upon producing the wire 3, as shown in Fig. 5, the production department 11 moves the core wire 4 or the electric wire 3 in sequence starting from the supply unit 20 up to winding unit 23 through the extrusion-coating unit 21 and cooling water bath 22. The production department 11 includes a plurality of pulleys 24 to move the core wire 4 or the electric wire 3.

[0071] The supply unit 20 supplies the core wire 4 on which the coating 5 is not coated. The extrusion-coating unit 21 extrusion-coats the core wire 4 supplied from the supply unit 20 with electrically insulating synthetic resin so as to form the coating 5. The cooling water bath 22 cools the coating 5. The winding unit 23 winds up the electric wire 3 consisting of the core wire 4 and the coating 5 around a drum or the like after cutting the electric wire 3 into, for example, 500 m - 2000 m.

[0072] Thus, when the first production data DT1 is inputted, the production department 11 produces a necessary length of the wire 3, the outer surface 5a of which is monochrome P such as white, per a product number on the basis of the first production data DT1. Therefore, the outer surface 5a of the wire 3 produced by the production department 11 has the same color at least among the wires 3 having the same size. Preferably, the outer surfaces 5a of all the wires 3 produced by the production department 11 have the same color.

[0073] When the first production data DT1 is inputted, the production department 11 makes the first confirmation data DK1. The production department 11 forwards the first confirmation data DK1 to the data integration module 13 through the input module 18 and to the coloring/cutting department 12. The production department 11 conveys the wire 3 produced on the basis of the first production data DT1 to the coloring/cutting department 12. Thus, the production department 11 produces the monochrome wire 3 having the product number and length according to the first production data DT1 and conveys the produced wire 3 to the coloring/cutting department 12. When the first production data DT1 is forwarded from the production control department 10, the production department 11 forwards the first confirmation data DK1, which indicates a date when the amount of the wire 3 according to the first production data DT1 is conveyable to the coloring/cutting department 12, to both production control department 10 and coloring/cutting department 12.

[0074] The production department 11 may produce an electric wire 3 which is non-colored as a wire 3 which is monochrome P. In this specification, "non-colored" means a state in which a coloring agent is not added to the synthetic resin of the coating 5 of the electric wire 3, that is, "non-colored" means a color of the synthetic resin itself. That is, the "non-colored" is an example of the monochrome P.

[0075] As the coloring/cutting department 12, there is, for example, a wiring harness assembling line in a plant of a wiring harness. When the second production data DT2 is inputted and the monochrome P wire 3 (that is, the wire 3 having a single color P) is conveyed from the production department 11, on the basis of the second production data DT2, the coloring/cutting department 12 marks the wire 3 per its product number with a mark 8 having a desired shape and desired colors B, R, then cuts the wire 3 into a desired length. Further, when the first production data DT1 is inputted and the first confirmation data DK1 is inputted from the production department 11, the coloring/cutting department 12 makes the second confirmation data DK2. The coloring/cutting department 12 forwards the second confirmation data DK2 to the data integration module 13 through the input module 18. Thus, according to the second production data DT2, the coloring/cutting department 12 colors the outer surface 5a of the monochrome P wire 3 with a desired colors B, R, forms the mark 8 on the outer surface 5a, and cuts the wire 3 into a desired length. When the second production data DT2 is forwarded from the production control department 10 and the first confirmation data DK1 is forwarded from the production department 11, the coloring/cutting department 12 forwards the second confirmation data DK2, which indicates a date when the colored and cut wire 3 according to the second production data DT2 is obtained, to the production control department 10.

[0076] As shown in Fig. 6, the coloring/cutting department 12 includes an electric wire cutting device 25 and electric wire coloring device 26. As shown in Fig. 6, the cutting device 25 includes a body 27 placed on a floor or the like in a plant, measuring machine 28, and cutting machine 29. The body 27 is formed in a box-shape. The measuring machine 28 has a pair of belt-forwarding units 30. The belt-forwarding units 30 includes a drive pulley 31 rotated by a motor or the like, a plurality of idler pulleys 32, and endless belt 33 stretched around the pulleys 31 and 32. The endless belt 33 rotates around the pulleys 31 and 32.

[0077] The pair of the belt-forwarding units 30 puts the wire 3 therebetween and rotates the endless belt 33 by rotating the drive pulley 31 synchronously so as to forward the wire 3 by a specific length. At this time, the pair of the belt-forwarding units 30 moves the wire 3 along an arrow K shown in Fig. 6, which is parallel to the longitudinal direction of the wire 3.

[0078] The cutting machine 29 is arranged at the downstream side of the pair of the belt-forwarding units 30. The cutting machine 29 includes a pair of cutting blades 34 and 35. The pair of cutting blades 34 and 35 is arranged in the vertical direction. The cutting blades 34 and 35 approach or leave each other in the vertical direction. When the cutting blades 34 and 35 approach each other, they put the wire 3 forwarded by the pair of the belt-forwarding units 30 therebetween, then cut the wire 3. When the cutting blades 34 and 35 leave each other, they leave

the wire 3 of course.

[0079] The cutting machine 25 puts the wire 3 between the pair of the belt-forwarding units 30, the cutting blades 34 and 35 being parted away from each other, and forwards the wire 3 along the arrow K. After forwarding a specific length of the wire 3, the drive pulley 31 is halted. As the cutting blades 34 and 35 approach each other, they put the wire 3 therebetween and cut the wire 3.

[0080] The coloring machine 26 forms the mark 8 on the outer surface 5a of the wire 3. As shown in Fig. 7, the coloring machine 26 includes a plurality of coloring units 36, an encoder 37 as a detection means, and control device 38. In an example shown in Fig. 7, a pair of the coloring units 36 are provided. A plurality of the coloring units 36 are arranged along the arrow K.

[0081] As shown in Fig. 6, a plurality of the coloring units 36 is placed between the pair of the belt-forwarding units 30 and the pair of the cutting blades 34, 35. Each coloring unit 36 includes a nozzle 39, valve 40 and so on. The nozzle 39 faces the wire 3 which is moved along the arrow K by the pair of the belt-forwarding units 30. A coloring agent of the first color B is supplied into the nozzle 39 of one coloring unit 36 from a coloring agent supply source 41 (shown in Fig. 7), while a coloring agent of the second color R is supplied into the nozzle 39 of another coloring unit 36 from the coloring agent supply source 41.

[0082] The valve 40 is linked to the nozzle 39. Further, the valve 40 is linked to a pressurized gas supply source 42 (shown in Fig. 7). The pressurized gas supply source 42 supplies pressurized gas into the nozzle 39 through the valve 40. When the valve 40 is opened, a coloring agent in the nozzle 39 is spouted (ejected) toward the outer surface 5a of the wire 3 with the aid of the pressurized gas supplied from the pressurized gas supply source 42.

[0083] When the valve 40 is closed, the spouting of the coloring agent from the nozzle 39 is halted. Opening the valve 40 for a predetermined period of time, the coloring unit 36 spouts a specific amount of the coloring agent toward the outer surface 5a of the wire 3 according to a signal from the control device 38.

[0084] The coloring agent is a liquid substance, in which a coloring material (organic substance for use in industry) is dissolved and dispersed in water or other solvent. The organic substance is a dye or a pigment (mainly, organic substance and synthetic product). Sometimes, a dye is used as a pigment and a pigment is used as a dye. As a substantial example, the coloring agent is a coloring liquid or coating material.

[0085] The coloring liquid is a liquid, in which a dye is dissolved or dispersed in a solvent. The coating material is a material, in which a pigment is dispersed in a liquid dispersion. When the coloring liquid adheres on the outer surface 5a of the wire 3, the dye permeates into the coating 5. When the coating material adheres on the outer surface 5a of the wire 3, the pigment adheres on the outer surface 5a without permeating into the coating 5 of the wire 3. That is, the coloring unit 36 dyes a part of the

outer surface 5a of the wire 3 with a dye, or alternatively, coats a part of the outer surface 5a of the wire 3 with a pigment. That is, "marking" means to dye a part of the outer surface 5a of the wire 3 with a dye and to coat a part of the outer surface 5a of the wire 3 with a pigment.

[0086] Preferably, the solvent and liquid dispersion have an affinity to the synthetic resin of the coating 5 in order to securely permeate the dye into the coating 5 of the wire 3 or to make the pigment securely adhere to the outer surface 5a of the coating 5 of the wire 3.

[0087] The spouting means that a specific amount of a liquid coloring agent in a form of liquid drops is spouted under being biased from the nozzle 39 of the coloring unit 36 toward the outer surface 5a of the electric wire 3. Therefore, the nozzle 39 of the coloring unit 36 in the electric wire coloring device 26 according to the preferred embodiment spouts a specific amount of a liquid coloring agent in a form of liquid drops toward the outer surface 5a of the electric wire 3.

[0088] The encoder 37 measures information based on a length and speed of the movement of the wire 3 and outputs the information to the control device 38. The control device 38 is a computer which includes a known RAM, ROM and CPU. The control device 38 is linked to the encoder 37 and valve 40 so as to control the whole coloring machine 26.

[0089] The control device 38 memorizes the distances D1, D2 and D3, the diameters R1 and R2 of the point 6 and point 7, and the number of the points 6 and points 7 with regard to the marks 8 formed on the outer surface 5a of the wire 3. The control device 38 memorizes a number of different shapes of the mark 8. That is, control device 38 memorizes a plurality of patterns of shape of the mark 8. The control device 38 memorizes the distance between the nozzles 39 of the coloring unit 36. The control device 38 receives the second production data DT2 and so on. On the basis of the inputted second production data DT2, the information of the speed of the wire 3 and the distance between the nozzles 39, the control device 38 controls the valves 40 and pressurized gas supply source 42 so that the mark 8 is formed on the outer surface 5a of the wire 3 with a pattern which meets the second production data DT2.

[0090] When the coloring device 26 forms the mark 8 on the outer surface 5a of the wire 3, that is, marks the outer surface 5a of the wire 3, the pair of the belt-forwarding unit 30 moves the wire 3 along the arrow K. Then, the control device 38 controls the valve 40 and so on so as to spout a specific amount of the coloring agent toward the outer surface 5a of the wire 3 from the nozzle 39. The control device 38 forms the mark 8 on the outer surface 5a of the wire 3 with a pattern which meets the second production data DT2.

[0091] Thus, the coloring/cutting department 12 coats a coating material on the outer surface 5a of the coating 5 of the wire 3, or alternatively, dyes the outer surface 5a with a coloring liquid so as to mark the outer surface 5a with a specific pattern (that is, to form the mark 8 with

a desired shape and desired color). Further, the coloring/cutting department 12 cuts the marked wire 3 into a desired length.

[0092] When the electric wire production system 1 produces the electric wire 3, first at step S1 shown in Fig. 3, whether there is any input to the input department 9 or not is judged. If there is no input to the input department 9, the step S1 is repeated, and if there is an input to the input department 9, the process advances to step S2.

[0093] At step S2, the electric wire production data D are forwarded from the portable computer 9a of the input department 9 to the portable computer 10a of the production control department 10. Then, portable computer 10a forwards the first production data DT1 to the production department 11 and the second production data DT2 to the coloring/cutting department 12.

[0094] Then, the production department 11 forwards the first confirmation data DK1 to both portable computer 10a of the production control department 10 and coloring/cutting department 12. The coloring/cutting department 12 forwards the second confirmation data DK2 to the portable computer 10a of the production control department 10. The production control department 10 forwards the second confirmation data DK2 to the input department 9. Then, the production department 11 produces the monochrome P wire 3 per a product number with a length which meets the first production data DT1. Then, the process advances to step S3.

[0095] At step S3, the production department 11 conveys the monochrome P wire 3 produced to the coloring/cutting department 12. On the basis of the second production data DT2, in the coloring/cutting department 12, the coloring unit 36 spouts the coloring agent toward the outer surface 5a of the wire 3 so as to mark the outer surface 5a with a desired pattern and cut the wire 3 into a desired length. Then, the process advances to step S4. At step S4, in the coloring/cutting department 12, the wire 3 is subjected to a visual examination.

[0096] In the preferred embodiment, on the basis of the electric wire production data D inputted to the input department 9, the production control department 10 forwards the first production data Dt1, indicating a product number and length of the wire 3 to be produced, to the production department 11, and forwards the first production data DT2, indicating a product number, length and shape and color of the mark of the wire 3, to the coloring/cutting department 12. The production department 11 produces the required amount of the monochrome P wire 3 and conveys it to the coloring/cutting department 12. Accordingly, the amount (length) of the wire 3 to be stored in advance in the production department 11 can be restricted. The production department 11 produces the monochrome P wire 3. Accordingly, the type (color type) of the wire 3 to be stored in advance in the production department 11 can be restricted and there is no need to produce the wire 3 in advance.

[0097] The production department 11 produces a necessary amount (i.e. length) of the monochrome wire 3.

The coloring/cutting department 12 colors a part of the outer circumference 5a of the monochrome P wire 3 with a desired color B, R and desired shape and cuts the wire into a desired length. Therefore, the amount of wire 3 to be temporarily stored between the production department 11 and the coloring/cutting department 12 can be restricted.

[0098] Accordingly, a space for storing the wire 3 in advance can be saved and a space for storing the wire 3 temporarily during the production can be saved. The cost of the wire 3 and a product in which the wires 3 are used is prevented from increasing. The necessary length of the monochrome P wire 3 is produced, then the outer surface 5a of the monochrome P wire 3 is colored and then, the wire 3 is cut into a desired length. Therefore, an excess of the wire 3 does not take place for a period of time from the production of the wire 3 to the shipping. An excess of the wire 3 can be avoided and resource saving can be achieved.

[0099] The electric wire production data D indicating a product number, length, shape of a mark and color of the mark of the necessary electric wire 3 to be produced are inputted to the input department 9, then the production department 11 produces the wire 3 and then, the coloring/cutting department 12 colors and cuts the wire 3. Accordingly, once the electric wire production data D are inputted to the input department 9, the desired wire 3 is speedily produced. A period of time required from order-receiving to shipping after production can be reduced and there is no need to produce the wire 3 by estimating an amount of consumption in advance. A stock of an excess wire 3 can be avoided and the cost of the wire 3 and a product in which the wires 3 are used can be prevented from increasing.

[0100] If the wire 3 produced in the production department 11 is non-colored, the wire 3 can be securely colored with a desired color according to needs.

[0101] The coloring/cutting department 12 has a plurality of coloring units 36. Each coloring unit 36 spouts a specific amount of its own liquid coloring agent of specific color toward the outer surface 5a of the wire 3. The color of the coloring agent spouted from one coloring unit 36 is different from that of the coloring agent spouted from another coloring unit 36. Accordingly, a color for coloring the outer surface 5a of the wire 3 can be easily changed by changing the coloring unit 36. The outer surface 5a of the wire 3 can be easily colored with a desired color, and the coloring agent before changing the coloring agent with the coloring agent after changing the coloring agent can be prevented from mixing with each other, thereby preventing deterioration in the production yield of the wire 3.

[0102] The coloring unit 36 spouts a specific amount of the liquid coloring agent toward the outer surface 5a of the wire 3. Therefore, a shape of a mark 8 to be formed on the outer surface 5a of the wire 3 can be easily changed by changing the spouting amount and spouting time interval of the coloring agent from the coloring unit

36. The outer surface 5a of the wire 3 can be colored with a desired color without wasting the coloring agent. The cost of the wire 3 and a product in which the wires 3 are used can be prevented from increasing.

[0103] The production department 11 forwards the first confirmation data DK1, indicating the monochrome P electric wire 3 becoming conveyable, to the production control department 10 and the coloring/cutting department 12. The coloring/cutting department 12 forwards the second confirmation data DK2, indicating a date when the wire 3 colored and cut according to the second production data DT2 can be obtained, to the production control department 10. Therefore, the production control department 10 can grasp a state of progress in the manufacturing process of the wire 3. The coloring/cutting department 12 can confirm a date when the monochrome P wire 3 is conveyed.

[0104] After receiving an order of the wire 3, the necessary length of the monochrome P wire 3 is produced. Therefore, the amount (length) of the wire 3 to be stored in advance can be restricted. The monochrome wire 3 is used. Therefore, the type (color type) of the wire 3 to be stored in advance can be restricted.

[0105] The necessary length of the monochrome P wire 3 is produced, then the outer surface 5a is colored and then, the wire 3 is cut into a desired length. Therefore, there is no need to store the wire 3 temporarily between the production department 11 and coloring/cutting department 12. The amount of the wire 3 to be stored temporarily can be restricted for a period of time from receiving an order of the wire 3 to shipping the wire 3.

[0106] Accordingly, a space for storing the wire 3 in advance can be saved and a space for storing the wire 3 temporarily during the production can be saved. The cost of the wire 3 and a product in which the wires 3 are used is prevented from increasing. The necessary length of the monochrome P wire 3 is produced, then the outer surface 5a of the monochrome P wire 3 is colored and then, the wire 3 is cut into a desired length. Therefore, an excess of the wire 3 does not take place for a period of time from the production of the wire 3 to the shipping. An excess of the wire 3 can be avoided and resource saving can be achieved.

[0107] In the following, an electric wire production system 1 according to a second preferred embodiment of the present invention will be explained with reference to Figs. 8 - 12. The same reference numerals are used for the corresponding elements between the first and second preferred embodiments.

[0108] As shown in Figs. 8 and 9, the coloring/cutting department 12 described in the first preferred embodiment is replaced by a coloring department 12a in the second preferred embodiment. The other constitution of the electric wire production system 1 according to the second preferred embodiment is similar to that of the electric wire production system 1 according to the first preferred embodiment. As shown in Figs. 11 and 12, the coloring department 12a does not include the cutting ma-

chine 29, that is, the pair of the cutting blades 34, 35. The other constitution of the coloring department 12a is similar to that of the coloring/cutting department 12 in the first preferred embodiment.

[0109] The coloring department 12a colors the outer surface 5a having the monochrome P of the wire 3 produced in the production department 11 with a desired mark 8 and desired colors B, R. According to the second production data DT2 forwarded from the production control department 10, the coloring department 12a colors the outer surface 5a having the monochrome P of the wire 3 with desired colors B, R and forms a desired mark 8 on the outer surface 5a.

[0110] The coloring department 12a includes a plurality of coloring units 36 for spouting a specific amount of a liquid coloring agent toward the outer surface 5a of the wire 3. The color of the coloring agent spouted from one coloring unit 36 is different from that of the coloring agent spouted from another coloring unit 36. According to the second production data DT2, the coloring units 36 spout the respective liquid coloring agents toward the outer surface 5a of the wire 3.

[0111] The coloring department 12a receives the first confirmation data DK1, indicating a date when the amount of the wire 3 according to the first production data DT1 is conveyable to the coloring department 12a, from the production department 11. When the second production data DT2 is forwarded from the production control department 10 and the first confirmation data DK1 is forwarded from the production department 11, the coloring department 12a forwards the second confirmation data DK2, which indicates a date when the colored wire 3 according to the second production data DT2 is obtained, to the production control department 10.

[0112] When the wire 3 is produced by using the electric wire production system 1 according to the second preferred embodiment, first at step S1 shown in Fig. 10, whether there is any input to the input department 9 or not is judged. If there is no input to the input department 9, the step S1 is repeated, and if there is an input to the input department 9, the process advances to step S2.

[0113] At step S2, the electric wire production data D are forwarded from the portable computer 9a of the input department 9 to the portable computer 10a of the production control department 10. Then, portable computer 10a forwards the first production data DT1 to the production department 11 and the second production data DT2 to the coloring department 12a.

[0114] Then, the production department 11 forwards the first confirmation data DK1 to both portable computer 10a of the production control department 10 and coloring department 12a. The coloring department 12a forwards the second confirmation data DK2 to the portable computer 10a of the production control department 10. The production control department 10 forwards the second confirmation data DK2 to the input department 9. Then, the production department 11 produces the monochrome P wire 3 per a product number with a length which meets

the first production data DT1. Then, the process advances to step S3a.

[0115] At step S3a, the production department 11 conveys the monochrome P wire 3 produced to the coloring department 12a. On the basis of the second production data DT2, in the coloring department 12a, the coloring unit 36 spouts the liquid coloring agent toward the outer surface 5a of the wire 3 so as to mark the outer surface 5a with a desired pattern. Then, the process advances to step S4. At step S4, in the coloring department 12a, the wire 3 is subjected to a visual examination.

[0116] According to the second preferred embodiment, similarly to the first preferred embodiment, the amount (length) of the wire 3 to be stored in advance in the production department 11 can be restricted. Further, the types (color types) of the wire 3 to be stored in advance in the production department 11 can be restricted and there is no need to produce the wire 3 in advance. The amount of the wire 3 to be temporarily stored between the production department 11 and the coloring department 12a can be restricted.

[0117] Accordingly, a space for storing the wire 3 in advance can be saved and a space for storing the wire 3 temporarily during the production can be saved. The cost of the wire 3 and a product in which the wires 3 are used is prevented from increasing. The necessary length of the monochrome P wire 3 is produced, then the outer surface 5a of the monochrome P wire 3 is colored. Therefore, an excess of the wire 3 does not take place for a period of time from the production of the wire 3 to the shipping. An excess of the wire 3 can be avoided and resource saving can be achieved.

[0118] The electric wire production data D indicating a product number, length, shape of a mark and color of the mark of the necessary electric wire 3 to be produced are inputted to the input department 9, then the production department 11 produces the wire 3 and then, the coloring department 12a colors the wire 3. Accordingly, once the electric wire production data D are inputted to the input department 9, the desired wire 3 is speedily produced. A period of time required from order-receiving to shipping after production can be reduced and there is no need to produce the wire 3 by estimating an amount of consumption in advance. A stock of an excess wire 3 can be avoided and the cost of the wire 3 and a product in which the wires 3 are used can be prevented from increasing.

[0119] If the wire 3 produced in the production department 11 is non-colored, the wire 3 can be securely colored with a desired color according to needs.

[0120] The coloring department 12a has a plurality of coloring units 36. Each coloring unit 36 spouts a specific amount of its own liquid coloring agent of specific color toward the outer surface 5a of the wire 3. The color of the coloring agent spouted from one coloring unit 36 is different from that of the coloring agent spouted from another coloring unit 36. Accordingly, a color for coloring the outer surface 5a of the wire 3 can be easily changed by changing the coloring unit 36. The outer surface 5a

of the wire 3 can be easily colored with a desired color, and the coloring agent before changing the coloring agent with the coloring agent after changing the coloring agent can be prevented from mixing with each other, thereby preventing deterioration in the production yield of the wire 3.

[0121] The coloring unit 36 spouts a specific amount of the liquid coloring agent toward the outer surface 5a of the wire 3. Therefore, a shape of a mark 8 to be formed on the outer surface 5a of the wire 3 can be easily changed by changing the spouting amount and spouting time interval of the coloring agent from the coloring unit 36. The outer surface 5a of the wire 3 can be colored with a desired color without wasting the coloring agent. The cost of the wire 3 and a product in which the wires 3 are used can be prevented from increasing.

[0122] The production department 11 forwards the first confirmation data DK1, indicating the monochrome P electric wire 3 becoming conveyable, to the production control department 10 and the coloring department 12a. The coloring department 12a forwards the second confirmation data DK2, indicating a date when the wire 3 colored according to the second production data DT2 can be obtained, to the production control department 10. Therefore, the production control department 10 can grasp a state of progress in the manufacturing process of the wire 3. The coloring department 12a can confirm a date when the monochrome P wire 3 is conveyed.

[0123] In the preferred embodiment described above, the production department 11 is separated from the coloring/cutting department 12. However, instead, as shown in Fig. 13, the coloring/cutting department 12 may be incorporated into the production department 11. In this case, preferably, the cooling water bath 22 is removed and the coloring/cutting department 12 is placed between the extrusion-coating unit 21 and the winding unit 23. In a case shown in Fig. 13, a space for placing an electric wire production line can be restricted. In a case shown in Fig. 13, of course the coloring/cutting department 12 can be replaced by the coloring department 12a.

[0124] In the preferred embodiment described above, there is provided a pair of the coloring units 36. However, instead, of course there may be provided three or more coloring units 36. As shown in Fig. 14, a plurality of coloring units 36 may be arranged around the wire 3 in the circumferential direction so that the whole circumference of the outer surface 5a of the wire 3 can be colored with the coloring agents. Further, in the preferred embodiment described above, the point 6 and point 7 are arranged having a distance therebetween, however, instead, the point 6 and point 7 may be overlapped with each other.

[0125] In the preferred embodiment described above, described are electric wires 3 which constitute a wiring harness to be mounted on a motor vehicle. However, of course the wire 3 can be also applied to various electronic equipment such as a portable computer and various electric machines.

[0126] As the means for coloring an electric wire 3,

various means such as dipping, spraying, injection, printing or transcribing may be employed. As the coloring liquid or coating material, various materials such as acrylic-based coating material, ink (dye-based or pigment-based), and ultraviolet (UV) ink may be used.

[INDUSTRIAL APPLICABILITY]

[0127] As explained above, in the present invention, on the basis of the electric wire production data inputted to the input department, the production control department forwards the first production data indicating a product number and length of an electric wire to be produced to the production department and the second production data indicating a product number, length, shape of a mark and color of the mark of an electric wire to be produced to the coloring/cutting department. The production department produces a necessary amount of the monochrome wire and conveys it to the coloring/cutting department. Since the production department produces the monochrome wire, the amount of the wire to be stored in advance in the production department can be restricted. Further, since the production department produces the monochrome wire, the amount of the wires having various types of color to be stored in advance in the production department can be restricted, there is no need to change the color and therefore, no need to produce the wire in advance.

[0128] The production department produces a necessary amount (i.e. length) of the monochrome wire. The coloring/cutting department colors the outer circumference of the monochrome wire with a desired color, forms a desired mark, and cuts the wire into a desired length. Therefore, the amount of wire to be temporarily stored between the production department and the coloring/cutting department can be restricted.

[0129] Accordingly, a space for storing the wire in advance can be saved and a space for storing the wire temporarily during the production can be saved. The cost of the wire and a product in which the wires are used is prevented from increasing. The necessary length of the monochrome wire is produced, then the outer surface of the monochrome wire is colored and then, the wire is cut into a desired length so as to ship it to the customer. Therefore, an excess of the wire does not take place for a period of time from the production of the wire to the shipping. An excess of the wire can be avoided and resource saving can be achieved.

[0130] The electric wire production data indicating a product number, length, shape of a mark and color of the mark of the necessary electric wire to be produced are inputted to the input department, then the production department produces the wire and then, the coloring/cutting department colors and cuts the wire. Accordingly, once the electric wire production data are inputted to the input department, the desired wire is speedily produced. A period of time required from order-receiving to shipping after production can be reduced and there is no need to pro-

duce the wire by estimating an amount of consumption in advance. A stock of an excess wire can be avoided and the cost of the wire and a product in which the wires are used can be prevented from increasing.

[0131] In the present invention, after receiving an order, the wire produced in the production department is non-colored. Therefore, the non-colored wire can be securely colored with a desired color according to needs.

[0132] In the present invention, the coloring/cutting department has a plurality of coloring units. Each coloring unit spouts a specific amount of its own coloring agent of specific color toward the outer surface of the wire. The color of the coloring agent spouted from one coloring unit is different from that of the coloring agent spouted from another coloring unit. Accordingly, a color for coloring the outer surface of the wire can be easily changed by changing the coloring unit. The outer surface of the wire can be easily colored with a desired color, and the coloring agent before changing the coloring agent with the coloring agent after changing the coloring agent can be prevented from mixing with each other, thereby preventing deterioration in the production yield of the wire.

[0133] The coloring unit spouts a specific amount of the coloring agent toward the outer surface of the wire. Therefore, a shape of a mark to be formed on the outer surface of the wire can be easily changed by changing the spouting amount and spouting time interval of the coloring agent from the coloring unit. The outer surface of the wire can be colored with a desired color without wasting the coloring agent. The cost of the wire and a product in which the wires are used can be prevented from increasing.

[0134] In the present invention, the production department forwards the first confirmation data, indicating the monochrome electric wire becoming conveyable, to the production control department and the coloring/cutting department. Therefore, the production control department can grasp a state of progress in the manufacturing process of the wire. The coloring/cutting department can confirm a date when the monochrome wire is conveyed.

[0135] In the present invention, the coloring/cutting department forwards the second confirmation data, indicating a date when the wire colored and cut according to the second production data can be obtained, to the production control department. Accordingly, the production control department can securely grasp a state of progress in the manufacturing process of the wire.

[0136] In the present invention, on the basis of the electric wire production data inputted to the input department, the production control department forwards the first production data indicating a product number and length of an electric wire to be produced to the production department and the second production data indicating a product number, length, shape of a mark and color of the mark of an electric wire to be produced to the coloring department. The production department produces a necessary amount of the monochrome wire and conveys it to the coloring department. Since the production department

produces the monochrome wire, the amount of the wire to be stored in advance in the production department can be restricted. Further, since the production department produces the monochrome wire, the amount of the wires having various types of color to be stored in advance in the production department can be restricted, there is no need to change the color and therefore, no need to produce the wire in advance.

[0137] The production department produces a necessary amount (i.e. length) of the monochrome wire. The coloring department colors the outer circumference of the monochrome wire with a desired color and forms a desired mark. Therefore, the amount of wire to be temporarily stored between the production department and the coloring department can be restricted.

[0138] Accordingly, a space for storing the wire in advance can be saved and a space for storing the wire temporarily during the production can be saved. The cost of the wire and a product in which the wires are used is prevented from increasing. The necessary length of the monochrome wire is produced, then the outer surface of the monochrome wire is colored and then, the wire is shipped to the customer. Therefore, an excess of the wire does not take place for a period of time from the production of the wire to the shipping. An excess of the wire can be avoided and resource saving can be achieved.

[0139] The electric wire production data indicating a product number, length, shape of a mark and color of the mark of the necessary electric wire to be produced are inputted to the input department, then the production department produces the wire and then, the coloring department colors the wire. Accordingly, once the electric wire production data are inputted to the input department, the desired wire is speedily produced. A period of time required from order-receiving to shipping after production can be reduced and there is no need to produce the wire by estimating an amount of consumption in advance. A stock of an excess wire can be avoided and the cost of the wire and a product in which the wires are used can be prevented from increasing.

[0140] In the present invention, after receiving an order, the wire produced in the production department is non-colored. Therefore, the non-colored wire can be securely colored with a desired color according to needs.

[0141] In the present invention, the coloring department has a plurality of coloring units. Each coloring unit spouts a specific amount of its own coloring agent of specific color toward the outer surface of the wire. The color of the coloring agent spouted from one coloring unit is different from that of the coloring agent spouted from another coloring unit. Accordingly, a color for coloring the outer surface of the wire can be easily changed by changing the coloring unit. The outer surface of the wire can be easily colored with a desired color, and the coloring agent before changing the coloring agent with the coloring agent after changing the coloring agent can be prevented from mixing with each other, thereby preventing

deterioration in the production yield of the wire.

[0142] The coloring unit spouts a specific amount of the coloring agent toward the outer surface of the wire. Therefore, a shape of a mark to be formed on the outer surface of the wire can be easily changed by changing the spouting amount and spouting time interval of the coloring agent from the coloring unit. The outer surface of the wire can be colored with a desired color without wasting the coloring agent. The cost of the wire and a product in which the wires are used can be prevented from increasing.

[0143] In the present invention, the production department forwards the first confirmation data, indicating the monochrome electric wire becoming conveyable, to the production control department and the coloring department. Therefore, the production control department can grasp a state of progress in the manufacturing process of the wire. The coloring department can confirm a date when the monochrome wire is conveyed.

[0144] In the present invention, the coloring department forwards the second confirmation data, indicating a date when the wire colored according to the second production data can be obtained, to the production control department. Accordingly, the production control department can securely grasp a state of progress in the manufacturing process of the wire.

Claims

1. An electric wire production system (1) comprising:

a production department (11) for producing an electric wire (3), an outer surface (5a) of which is monochrome; and
a coloring department (12a) for coloring an outer surface (5a) of an electric wire (3) with a desired mark (8) having a desired color (B, R);

characterized by

an input department (9) to which electric wire production data (D) indicating a product number and length of an electric wire (3) to be produced, a shape of a mark (8) to be formed on an outer surface (5a) of the electric wire (3), and a color of the mark (8) are inputted; and
a production control department (10) to which the electric wire production data (D) is inputted from the input department (9), wherein the production control department (10) makes first production data (DT1) indicating a product number and length of an electric wire (3) to be produced on the basis of the electric wire production data (D) inputted from the input department (9) and forwards the first production data (DT1) to the production department (11), and makes second production data (DT2) indicating a product number of an electric wire (3) to be produced, a shape of a mark (8) to be formed

on an outer surface (5a) of the electric wire (3), and a color of the mark (8) on the basis of the electric wire production data (D) and forwards the second production data (DT2) to the coloring department (12a),

the production department (11) produces a monochrome electric wire (3) having a product number and length according to the first production data (DT1) and conveys the monochrome electric wire (3) to the coloring department (12a), and

the coloring department (12a) colors an outer surface (5a) of the monochrome electric wire with a desired color (B, R) according to the second production data (DT2) and forms a desired mark (8) on the outer surface (5a),

wherein the production department (11) is configured such that, when the first production data (DT1) is forwarded from the production control department (10), the production department (11) forwards first confirmation data (DK1), which indicates a date when an amount of an electric wire (3) according to the first production data (DT1) becomes conveyable to the coloring department (12a), to both production control department (10) and coloring department (12a).

2. The electric wire production system (1) according to claim 1, wherein the monochrome electric wire (3) produced by the production department (11) is non-colored.

3. The electric wire production system (1) according to claim 1 or 2, wherein the coloring department (12a) comprises a plurality of coloring units (36), each for spouting a specific amount of coloring agent toward an outer surface (5a) of an electric wire (3), a color of the coloring agent varies depending on the coloring unit (36), and a plurality of the coloring units (36) spout the respective coloring agents toward the outer surface (5a) of the electric wire (3) according to the second production data (DT2).

4. The electric wire production system (1) according to claim 1, wherein the coloring department (12a) is configured such that, when the second production data (DT2) is forwarded from the production control department (10) and the first confirmation data (DK1) is forwarded from the production department (11), the coloring department (12a) forwards second confirmation data (DK2), which indicates a date when an electric wire (3) colored according to the second production data (DT2) is obtained, to the production control department (10).

5. The electric wire production system (1) according to any of claims 1 to 4, wherein the second production data (DT2) includes a length of an electric wire (3),

and
 wherein the coloring department (12a) is embodied
 as a coloring/cutting department for coloring an outer
 surface (5a) of an electric wire (3) with a desired
 mark (8) having a desired color (B, R) and for cutting
 the electric wire (3) into a desired length.

Patentansprüche

1. Ein elektrischer-Draht-Produktionssystem (1) aufweisend:

einen Produktionsabschnitt (11) zum Produzieren eines elektrischen Drahts (3), der eine monochrome Außenfläche (5a) hat, und einen Färbeabschnitt (12a) zum Färben einer Außenfläche (5a) eines elektrischen Drahts (3) mit einer gewünschten Markierung (8), welche eine gewünschte Farbe (B, R) hat,

gekennzeichnet durch

einen Eingabeabschnitt (9), an den elektrischer-Draht-Produktionsdaten (D) eingegeben werden, welche eine Produktnummer und Länge eines zu produzierenden elektrischen Drahtes (3), eine Form einer Markierung (8), die auf einer Außenfläche (5a) des elektrischen Drahtes (3) zu bilden ist, und eine Farbe der Markierung (8) angeben, und

einen Produktion-Steuerungsabschnitt (10), an den die elektrischer-Draht-Produktionsdaten (D) von dem Eingabeabschnitt (9) eingegeben werden, wobei

der Produktion-Steuerungsabschnitt (10) erste Produktionsdaten (DT1) erzeugt, welche eine Produktnummer und eine Länge eines zu produzierenden elektrischen Drahtes (3) angeben basierend auf den elektrischer-Draht-Produktionsdaten (D), die von dem Eingabeabschnitt (9) eingegeben werden, und die ersten Produktionsdaten (DT1) an den Produktionsabschnitt (11) weiterleitet, und zweite Produktionsdaten (DT2) erzeugt, welche eine Produktnummer eines zu produzierenden elektrischen Drahtes (3), eine Form einer Markierung (8), die an einer Außenfläche (5a) des elektrischen Drahtes (3) gebildet werden soll, und eine Farbe der Markierung (8) angeben basierend auf den elektrischer-Draht-Produktionsdaten (D) und die zweiten Produktionsdaten (DT2) zu dem Färbeabschnitt (12a) weiterleitet,

der Produktionsabschnitt (11) einen monochromen elektrischen Draht (3) produziert, der eine Produktnummer und eine Länge entsprechend den ersten Produktionsdaten (DT1) hat, und den monochromen elektrischen Draht (3) zu dem Färbeabschnitt (12a) befördert, und der Färbeabschnitt (12a) eine Außenfläche (5a)

des monochromen elektrischen Drahts entsprechend den zweiten Produktionsdaten (DT2) mit einer gewünschten Farbe (B, R) einfärbt und auf der Außenfläche (5a) eine gewünschte Markierung (8) bildet,

wobei der Produktionsabschnitt (11) so ausgebildet ist, dass, wenn die ersten Produktionsdaten (DT1) von dem Produktion-Steuerungsabschnitt (10) weitergeleitet werden, der Produktionsabschnitt (11) erste Bestätigungsdaten (DK1), die einen Zeitpunkt angeben, zu dem ein Betrag eines elektrischen Drahtes (3) entsprechend den ersten Produktionsdaten (DT1) zu dem Färbeabschnitt (12a) befördert werden kann, an sowohl den Produktion-Steuerungsabschnitt (10) als auch an den Färbeabschnitt (12a) weiterleitet.

2. Das elektrischer-Draht-Produktionssystem (1) gemäß Anspruch 1, wobei der von dem Produktionsabschnitt (11) produzierte monochrome elektrische Draht (3) ungefärbt ist.

3. Das elektrischer-Draht-Produktionssystem (1) gemäß Anspruch 1 oder 2, wobei der Färbeabschnitt (12a) eine Mehrzahl von Färbereinheiten (36) aufweist, jede zum Sprühen einer spezifischen Menge von Färbemittel auf eine Außenfläche (5a) eines elektrischen Drahts (3), wobei eine Farbe des Färbemittels abhängig von der Färbereinheit (36) variiert, und eine Mehrzahl der Färbereinheiten (36) die jeweiligen Färbemittel entsprechend den zweiten Produktionsdaten (DT2) auf die Außenfläche (5a) des elektrischen Drahtes (3) sprühen.

4. Das elektrischer-Draht-Produktionssystem (1) gemäß Anspruch 1, wobei der Färbeabschnitt (12a) so ausgebildet ist, dass, wenn die zweiten Produktionsdaten (DT2) von dem Produktion-Steuerungsabschnitt (10) weitergeleitet werden und die ersten Bestätigungsdaten (DK1) von dem Produktionsabschnitt (11) weitergeleitet werden, der Färbeabschnitt (12a) zweite Bestätigungsdaten (DK2), die einen Zeitpunkt angeben, zu dem ein elektrischer Draht (3), der entsprechend den zweiten Produktionsdaten (DT2) gefärbt ist, erhalten wird, an den Produktion-Steuerungsabschnitt (10) weiterleitet.

5. Das elektrischer-Draht-Produktionssystem (1) gemäß irgendeinem der Ansprüche 1 bis 4, wobei die zweiten Produktionsdaten (DT2) eine Länge eines elektrischen Drahtes (3) aufweisen, und wobei der Färbeabschnitt (12a) als ein Färbe-/Schneideabschnitt ausgeführt ist zum Färben einer Außenfläche (5a) eines elektrischen Drahtes (3) mit einer gewünschten Markierung (8), die eine gewünschte Farbe (B, R) hat und zum Schneiden des elektrischen Drahtes (3) auf eine gewünschte Länge

ge.

Revendications

1. Système de production de fils électriques (1), comprenant :

un service de production (11) destiné à produire un fil électrique (3), dont une surface externe (5a) est monochrome ; et

un service de coloration (12a) destiné à appliquer une couleur à une surface externe (5a) d'un fil électrique (3) au moyen d'un repère souhaité (8) d'une couleur souhaitée (B, R) ;

caractérisé par

un service de saisie (9) auquel des données de production de fils électriques (D) indiquant un numéro de produit et une longueur d'un fil électrique (3) à produire, une forme d'un repère (8) à former sur une surface externe (5a) du fil électrique (3) et une couleur du repère (8) sont appliquées en entrée ; et

un service de commande de production (10) auquel les données de production de fils électriques (D) sont appliquées en entrée à partir du service de saisie (9), dans lequel

le service de commande de production (10) réalise des premières données de production (DT1) indiquant un numéro de produit et une longueur d'un fil électrique (3) à produire, sur la base des données de production de fils électriques (D) appliquées en entrée à partir du service de saisie (9), et transfère les premières données de production (DT1) au service de production (11), et réalise des secondes données de production (DT2) indiquant un numéro de produit d'un fil électrique (3) à produire, une forme d'un repère (8) à former sur une surface externe (5a) du fil électrique (3) et une couleur du repère (8), sur la base des données de production de fils électriques (D), et transfère les secondes données de production (DT2) au service de coloration (12a) ;

le service de production (11) produit un fil électrique monochrome (3) présentant un numéro de produit et une longueur selon les premières données de production (DT1), et transmet le fil électrique monochrome (3) au service de coloration (12a) ; et

le service de coloration (12a) applique une couleur souhaitée (B, R) à une surface externe (5a) du fil électrique monochrome, selon les secondes données de production (DT2), et forme un repère souhaité (8) sur la surface externe (5a) ; dans lequel le service de production (11) est configuré de sorte que, lorsque les premières données de production (DT1) sont transmises

par le service de commande de production (10), le service de production (11) transmet des premières données de confirmation (DK1), lesquelles indiquent une date à laquelle une quantité d'un fil électrique (3) selon les premières données de production (DT1) devient transférable au service de coloration (12a), à la fois au service de commande de production (10) et au service de coloration (12a).

2. Système de production de fils électriques (1) selon la revendication 1, dans lequel le fil électrique monochrome (3) produit par le service de production (11) est non coloré.

3. Système de production de fils électriques (1) selon la revendication 1 ou 2, dans lequel le service de coloration (12a) comprend une pluralité d'unités de coloration (36) qui sont chacune destinées à pulvériser une quantité spécifique de colorant vers une surface externe (5a) d'un fil électrique (3), dans lequel une couleur du colorant varie en fonction de l'unité de coloration (36), et dans lequel une pluralité des unités de coloration (36) pulvérisent les colorants respectifs vers la surface externe (5a) du fil électrique (3) selon les secondes données de production (DT2).

4. Système de production de fils électriques (1) selon la revendication 1, dans lequel le service de coloration (12a) est configuré de sorte que, lorsque les secondes données de production (DT2) sont transmises par le service de commande de production (10) et lorsque les premières données de confirmation (DK1) sont transmises par le service de production (11), le service de coloration (12a) transmet des secondes données de confirmation (DK2), lesquelles indiquent une date à laquelle un fil électrique (3) coloré selon les secondes données de production (DT2) est obtenu, au service de commande de production (10).

5. Système de production de fils électriques (1) selon l'une quelconque des revendications 1 à 4, dans lequel les secondes données de production (DT2) incluent une longueur d'un fil électrique (3) ; et dans lequel le service de coloration (12a) se présente sous la forme d'un service de découpe/coloration destiné à appliquer une couleur à une surface externe (5a) d'un fil électrique (3) au moyen d'un repère souhaité (8) d'une couleur souhaitée (B, R), et à découper le fil électrique (3) selon une longueur souhaitée.

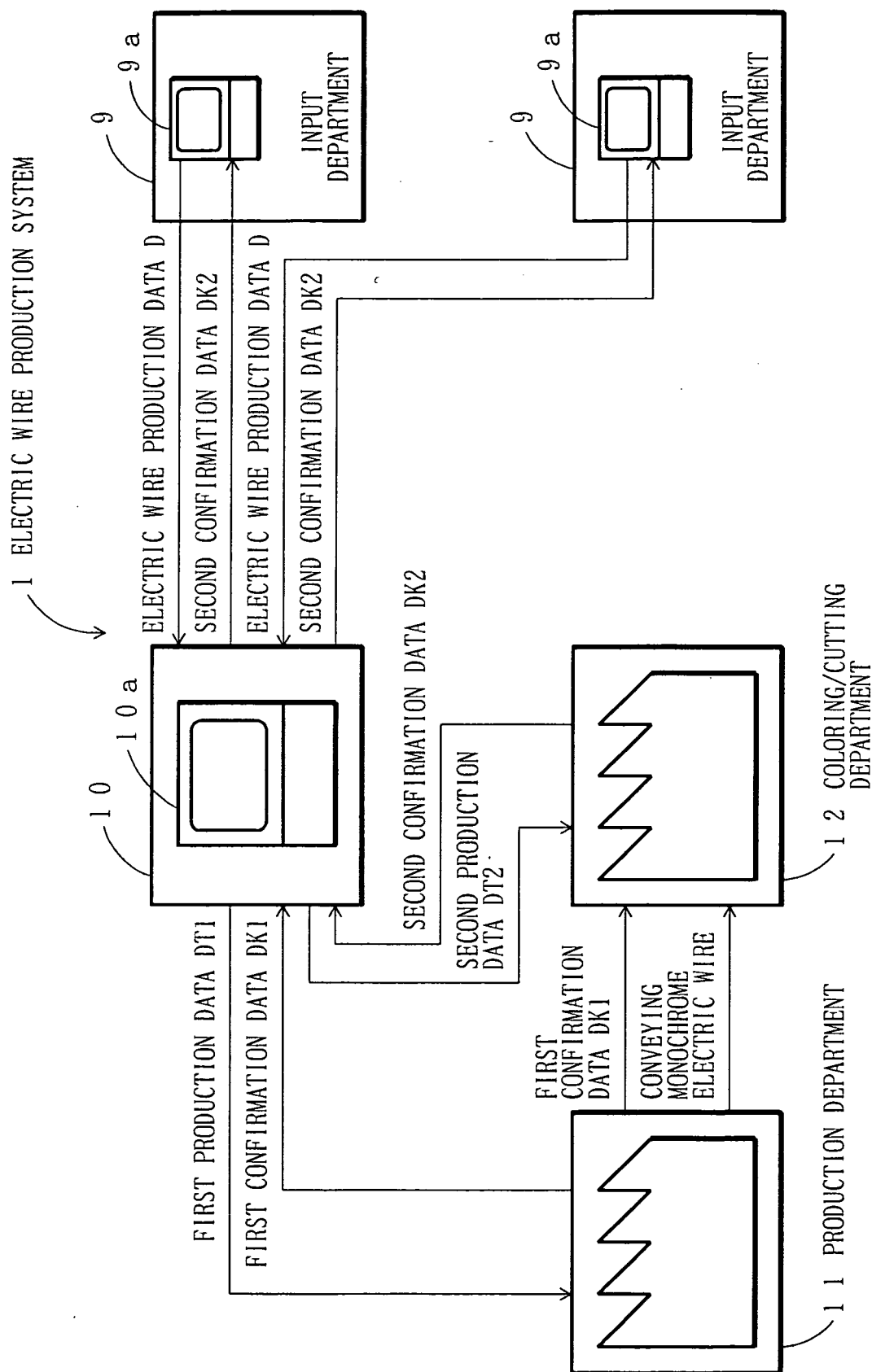


FIG. 1

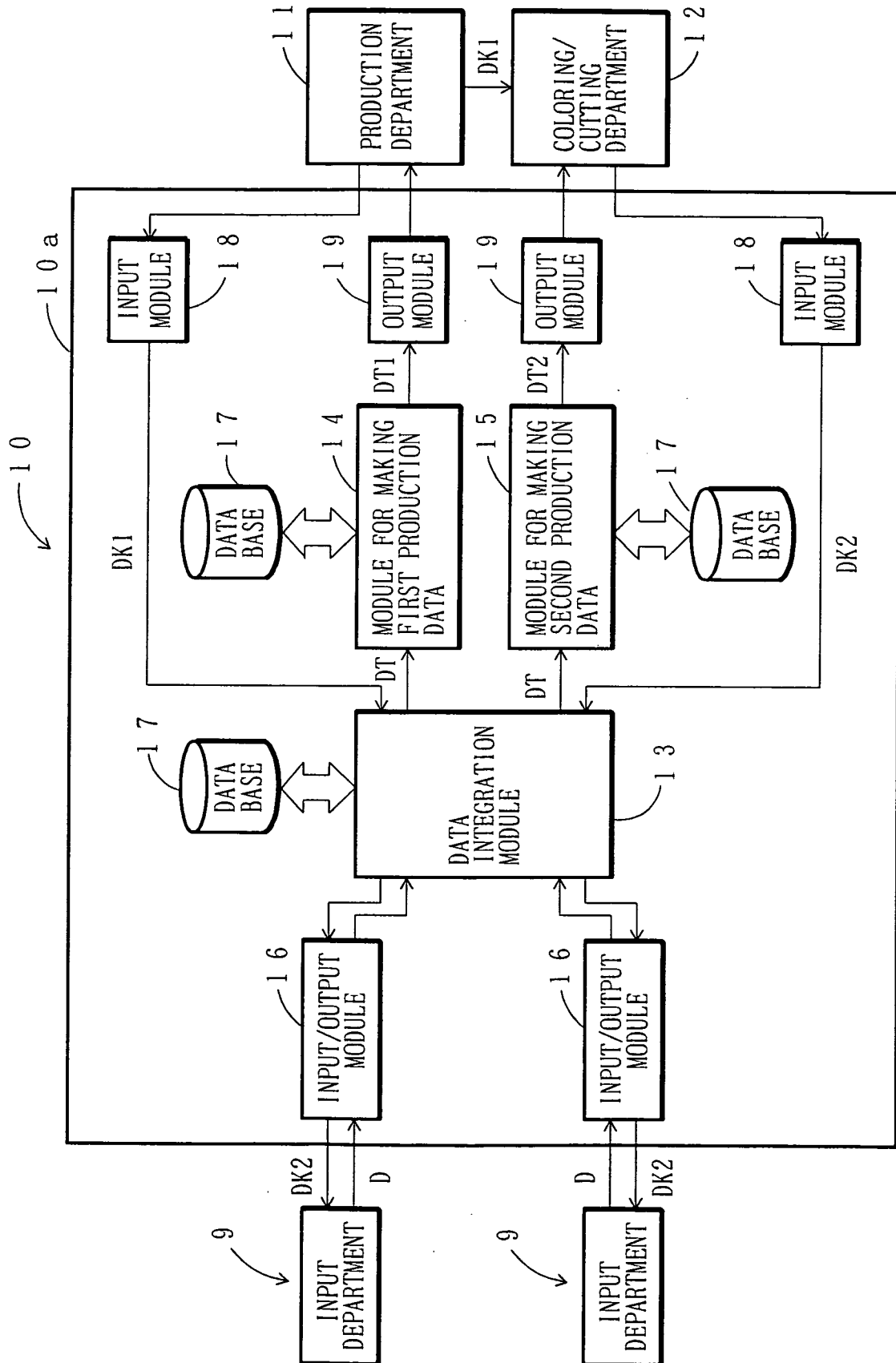


FIG. 2

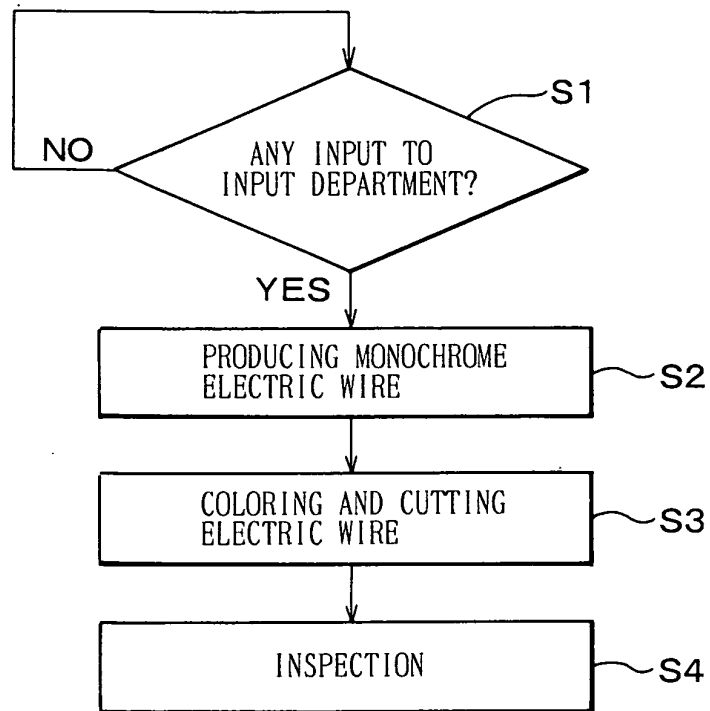


FIG. 3

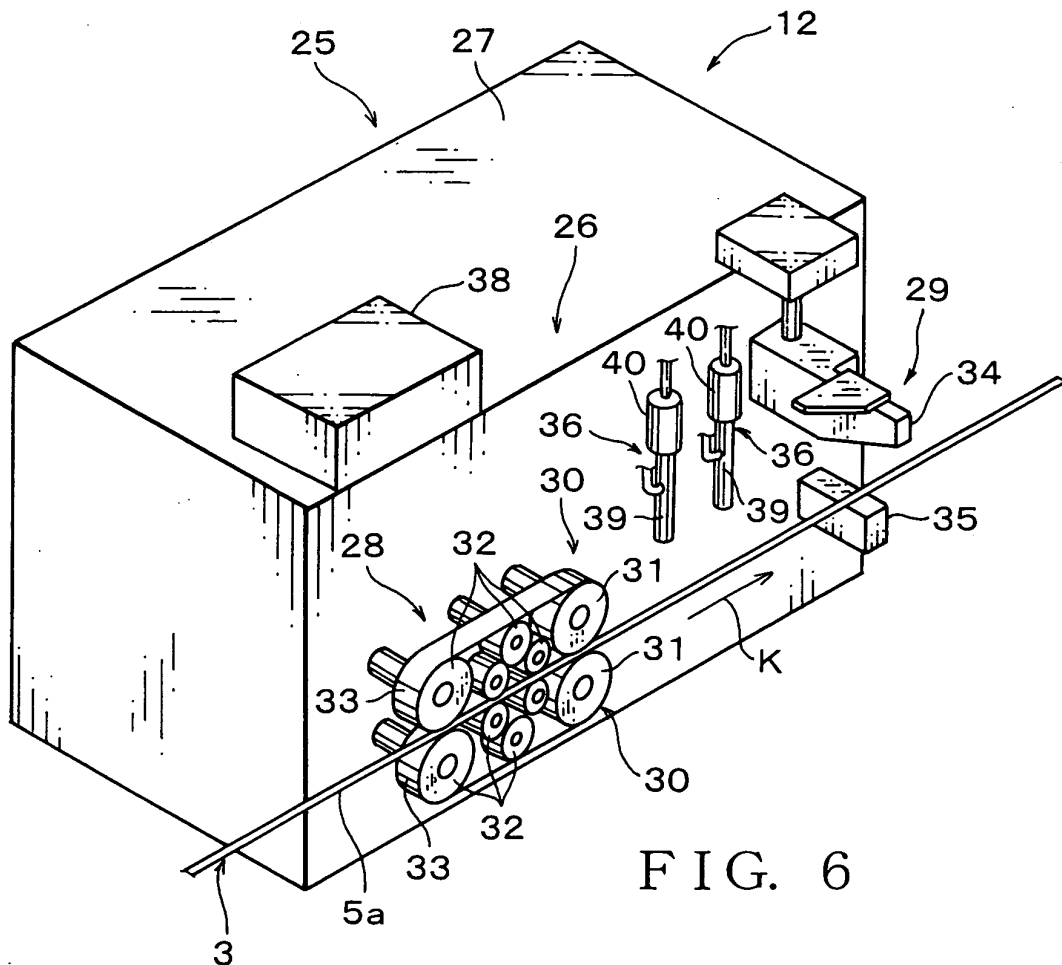
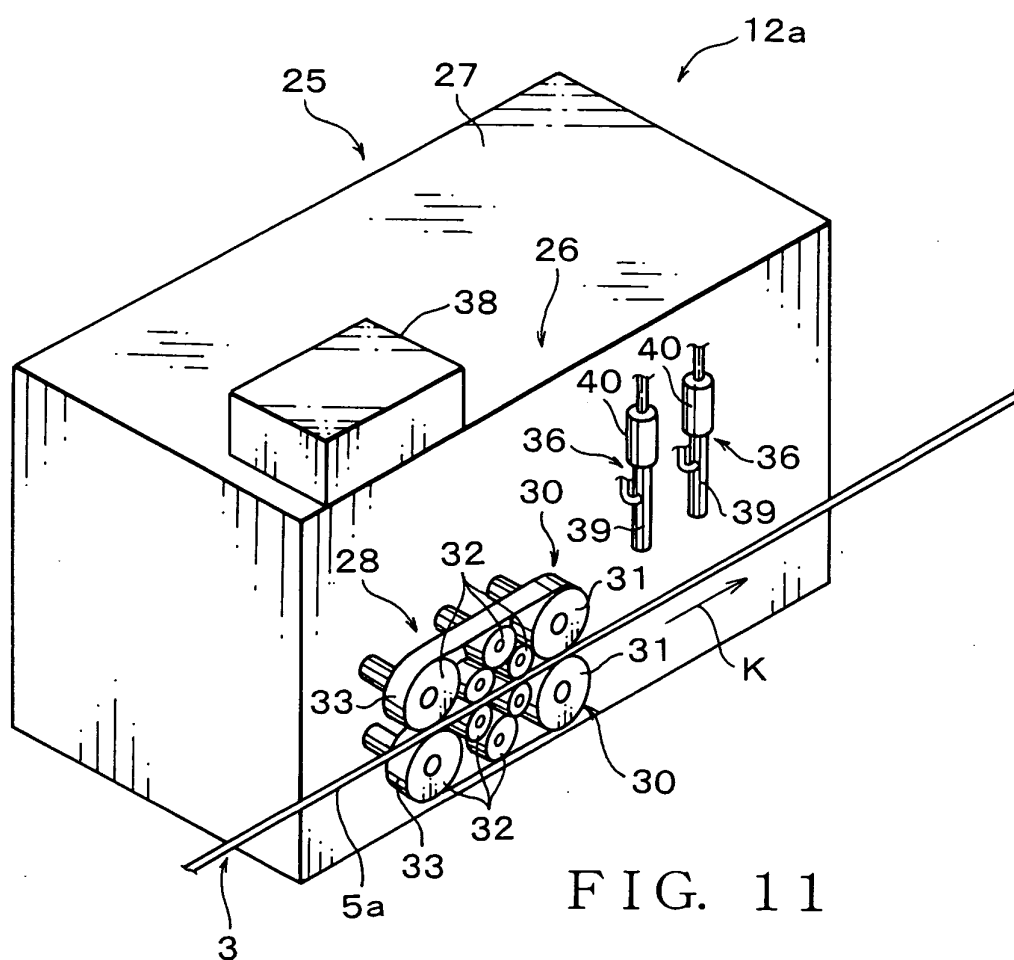
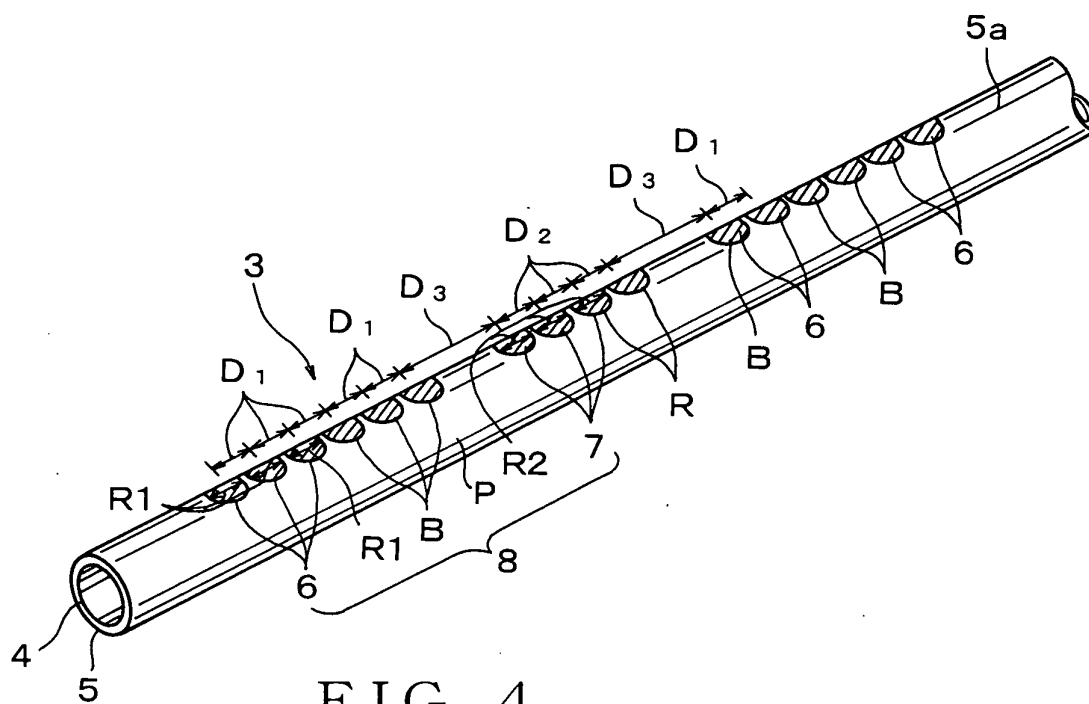


FIG. 6



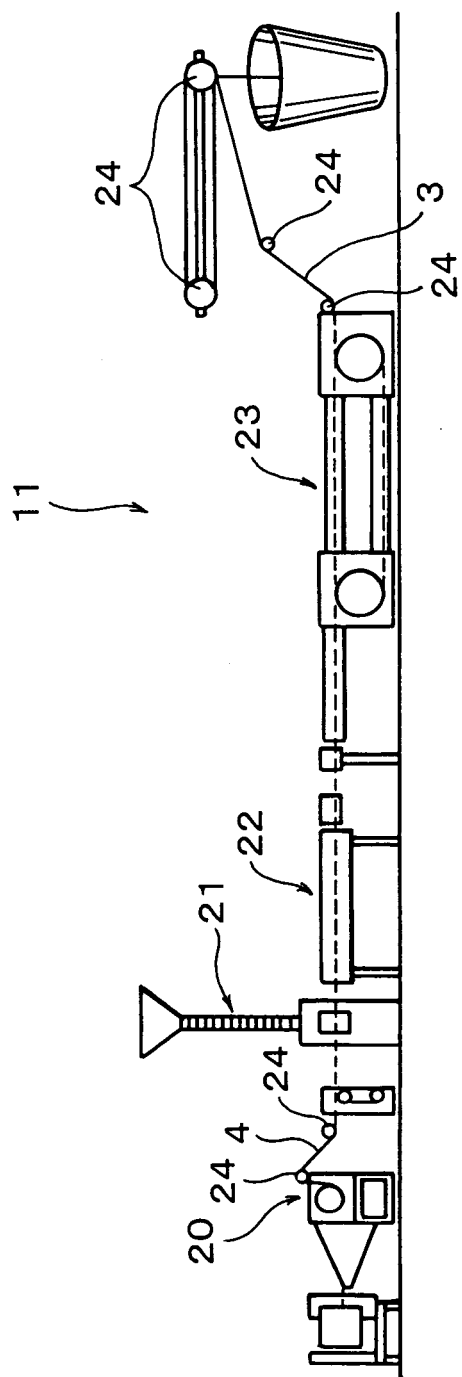


FIG. 5

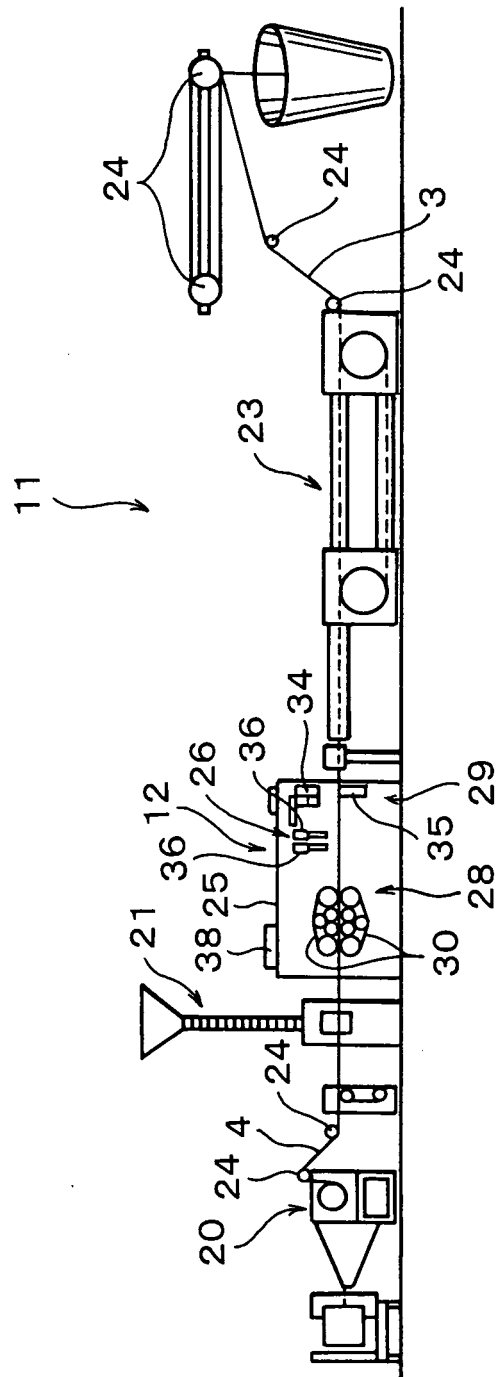


FIG. 13

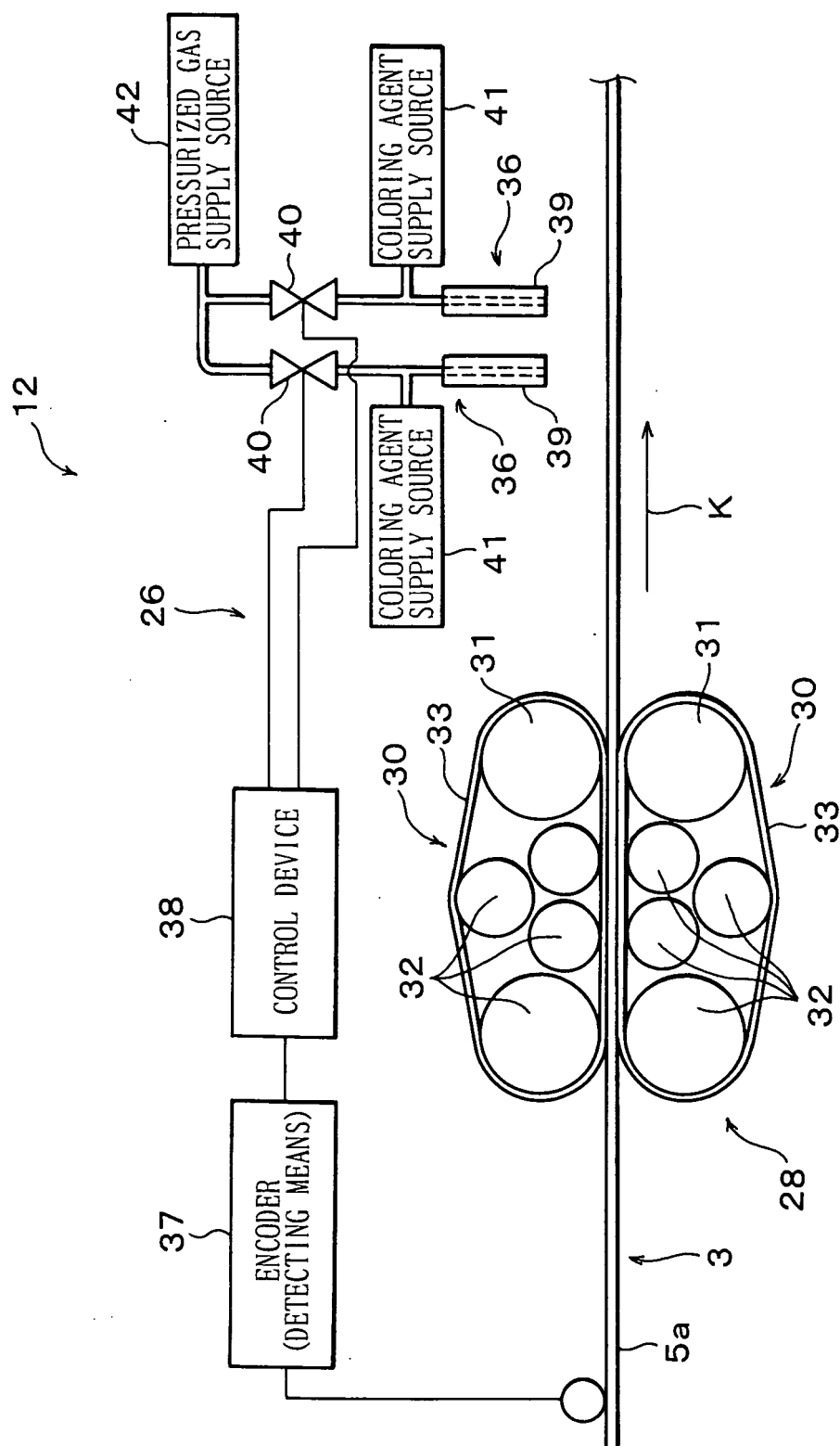


FIG. 7

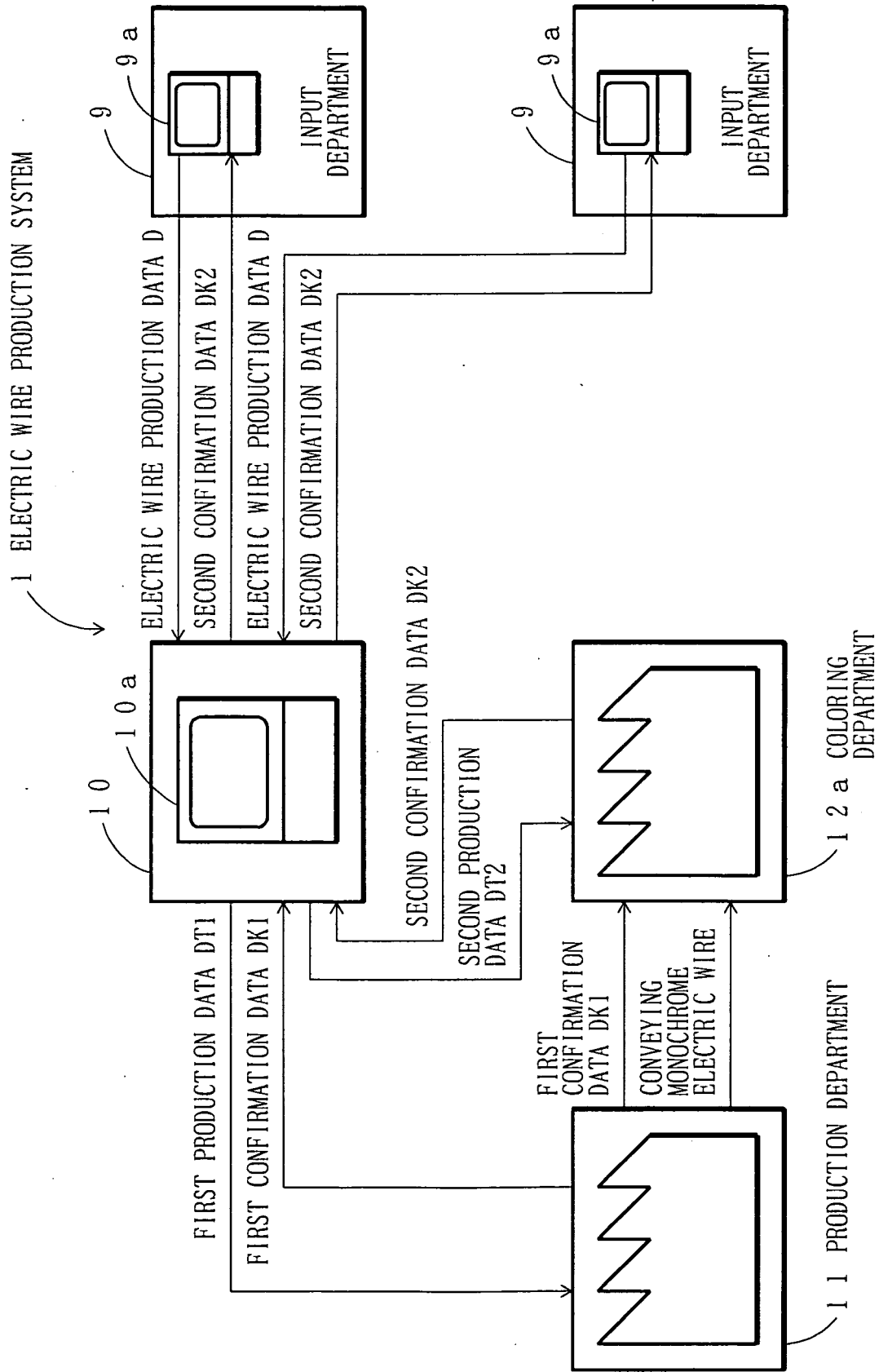


FIG. 8

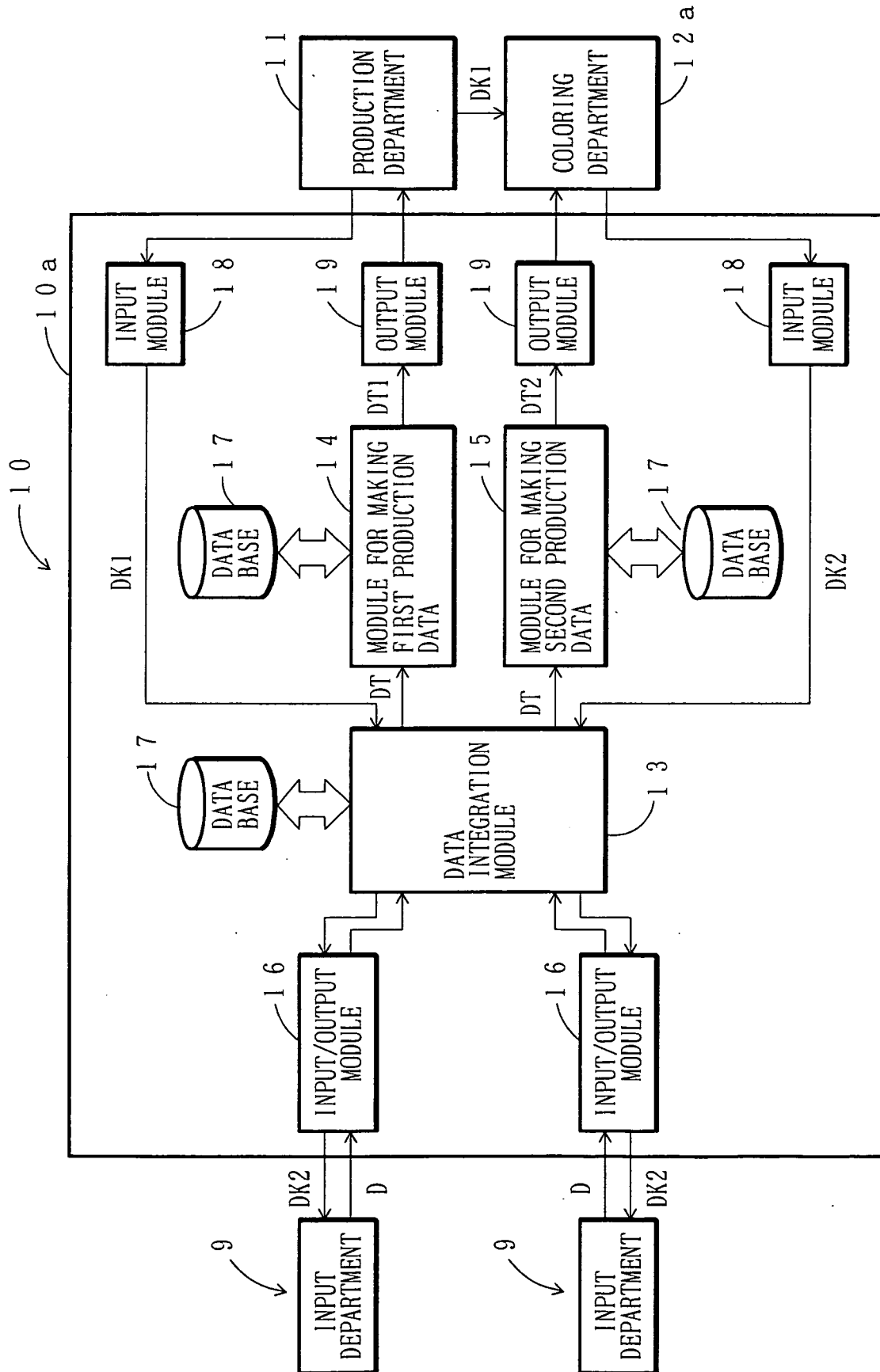


FIG. 9

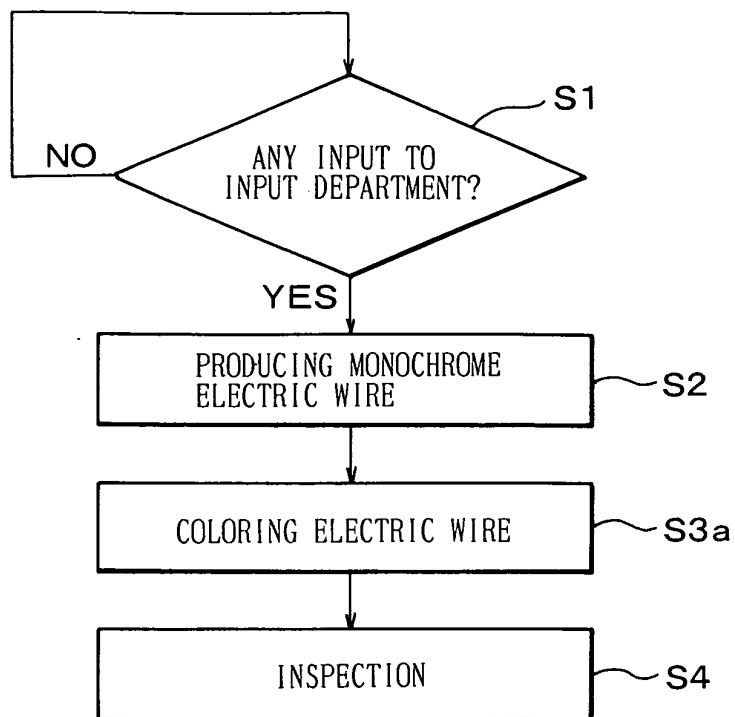


FIG. 10

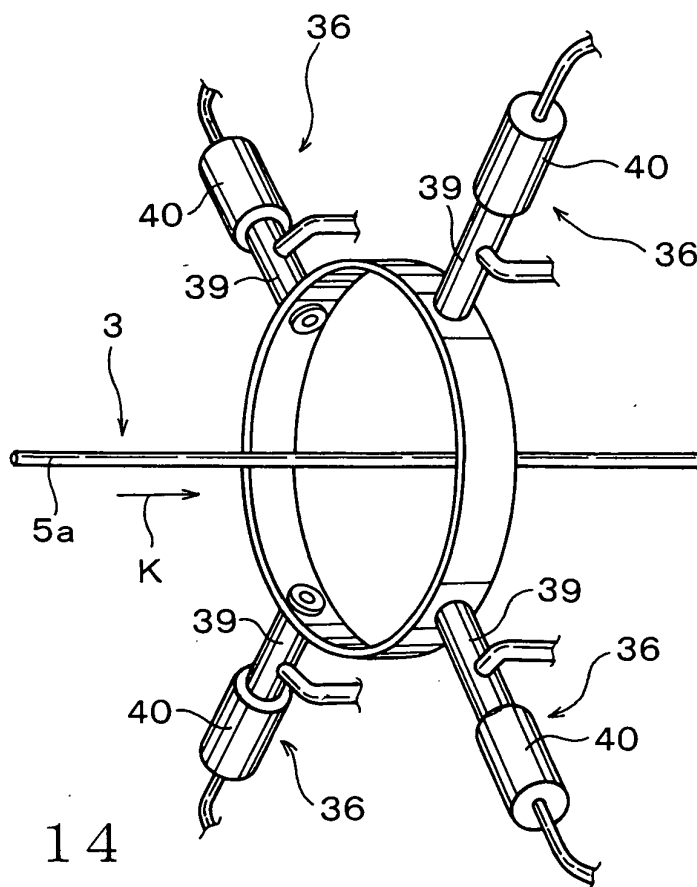


FIG. 14

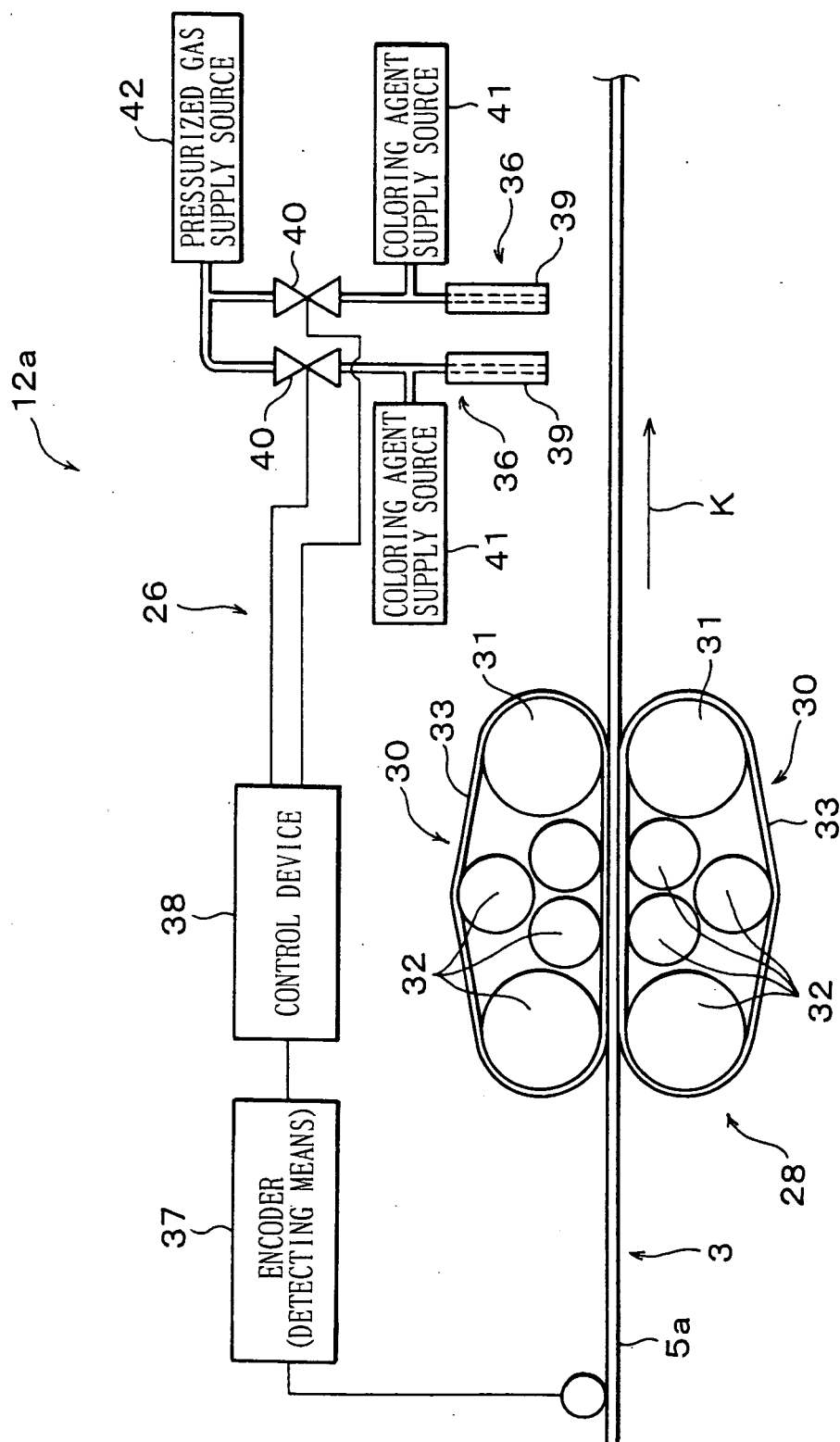


FIG. 12

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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