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(54) **APPARATUS AND METHOD FOR COLORING ELECTRIC WIRE**

VORRICHTUNG UND VERFAHREN ZUM FÄRBEN VON ELEKTRISCHEN DRÄHTEN

APPAREIL ET PROCÉDÉ DE COLORATION DE FIL ÉLECTRIQUE

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Description

Technical field

[0001] This invention relates to an apparatus and a method for coloring an outer surface of an electric wire moving in one direction.

Back ground

[0002] Various electronic devices are mounted on a motor vehicle as a mobile unit. Therefore, the motor vehicle is provided with a wiring harness for transmitting power from a power source and control signals from a computer to the electronic devices. The wiring harness includes a plurality of electric wires and connectors attached to an end of the wires.

[0003] The wire includes an electrically conductive core wire and a coating made of insulating synthetic resin, which coats the core wire. The wire is a so-called coated wire. A connector includes a terminal fitting and a connector housing that receives the terminal fitting therein. The terminal fitting, consisting of electrically conductive sheet metal or the like, is attached to an end of the wire and electrically connected to the core wire of the wire. The connector housing made of electrically insulating synthetic resin is formed in a box-shape. When the connector housing is connected to the electronic devices, each wires is connected to the corresponding electronic device through the terminal fitting, thereby the wiring harness transmits the desired electric power and signals to the electronic devices.

[0004] When the wiring harness is assembled, first the wire is cut into a specific length and then the terminal fitting is attached to an end of the wire after removing the coating near the end. A wire is connected to another wire according to the need. Afterward, the terminal fitting is inserted into the connector housing, thereby assembling the wiring harness.

[0005] The wire of the wiring harness must be distinguished in terms of the size of the core wire, the material of the coating (concerning with alteration in the materials depending upon heat-resisting property), and a purpose of use. The purpose of use means, for example, an air bag, antilock brake system (ABS), control signal, and system in a motor vehicle in which the wire is used, such as a power transmission system. Therefore, an outer surface of the electric wire used for the wiring harness is colored by a coloring apparatus for identifying the purpose of the use (for example, see Patent Documents 1 and 2).

[0006] A coloring apparatus for an electric wire disclosed in Patent Document 1 is installed on an electric wire cutting machine. The electric wire cutting machine cuts the electric wire in a specific length after moving the electric wire in a longitudinal direction. The coloring apparatus for an electric wire includes a plurality of spouting units and a duct having a suction unit. The spouting units

spout coloring material having different colors according to a predetermined coloring pattern. The duct is disposed downstream of the coloring apparatus in a moving direction of the electric wire.

[0007] The coloring apparatus for an electric wire having above described structure deposits the coloring material onto an outer surface of the electric wire according to the coloring pattern with the spouting units while the electric wire cutting machine moves the electric wire in the longitudinal direction, and then, dries the coloring material sufficiently in the duct.

[0008] A coloring apparatus for an electric wire as disclosed in Patent Document 2 includes a moving unit for moving an electric wire in a longitudinal direction thereof, a tank receiving coloring liquid, a delivery roller, a coloring roller, and a squeegee. The delivery roller is supported rotatably, and a part of the delivery roller is immersed in the coloring liquid received in the tank. The coloring roller is supported rotatably, and disposed at an upper side of the delivery roller and at a lower side of the electric wire to contact both the delivery roller and the electric wire. A plurality of dimples is formed on an outer peripheral wall of the coloring roller. The squeegee is disposed downstream of the coloring roller in the moving direction of the electric wire. The squeegee includes a hole for passing the electric wire, and eliminates the extra coloring liquid deposited on the outer surface of the electric wire.

[0009] In the coloring apparatus for an electric wire having above described structure, the delivery roller rotates while depositing the coloring liquid on the outer peripheral wall thereof to lead the coloring liquid into insides of the dimples of the coloring roller. Then, the coloring roller deposits the coloring liquid in the dimples onto the outer surface of the electric wire while the moving unit moves the electric wire in the longitudinal direction.

[Patent Document 1] Japanese Published Patent Application No. 2004-134371

[Patent Document 2] Japanese Published Patent Application No. 2003 303524

[0010] In Japanese Patent Application 08-184901 is disclosed a marking method of an electric wire for carrying out marking to a wire surface along with the longitudinal direction. An extruding machine for extruding a wire insulating body to the surface of a wire conductor is provided, and while an ink supplying unit for marking the surface of the insulating body is provided in the downstream of the extruding machine. A wire formed with the insulating body is carried in the longitudinal direction by the extruding machine, and while a motor is continuously operated so as to always discharge the ink from a nozzle, and a continuous straight mark can be thereby given to the surface of the insulating body. The ink can be intermittently discharged by turning on and off the motor so as to give a dot mark, and while length and pitch of the mark can be freely adjusted by the operation of motor.

[0011] Japanese Patent Application 08-184901 dis-

closes a marking device wherein a roll is installed to make following rotation with the feed of an electric wire arranged on a wire feeding line, and under the roll an ink supplying means is installed to supply ink to a circumferential groove provided at the peripheral surface of the roll, and beside it a doctor knife device is furnished to remove the surplus ink supplied to the circumferential groove in the roll. The doctor knife device has an arm to hold a doctor knife as capable of being put in pressure contact with and separated from the circumferential groove, and on the way of this arm a leaf spring is installed which can swing the doctor knife oscillatively in the direction across the width of the roll 22a.

[0012] Patent Application WO 2007/060832 A1 discloses an electric wire coloring device, by which a mark can be precisely formed at a designated position of an electric wire by restricting a slack of the electric wire. A coloring nozzle spouts a coloring agent toward an outer surface of an electric wire being forwarded along a longitudinal direction of the electric wire. An electric wire suction unit, which is for sucking the electric wire so as to prevent the electric wire from slackening, is provided between a guide roll situated nearest to the coloring nozzle among rolls arranged on the upstream side of the coloring nozzle in a forwarding direction K of the electric wire and a delivery roll situated nearest to the coloring nozzle rolls arranged on the downstream side of the coloring nozzle in the forwarding direction K.

Disclosure of the invention

Problem to be solved by the invention

[0013] In recent years, in view of an environmental problem a demand of changing a quick-drying solvent such as toluene with a water type solvent or an alcohols solvent as a solvent of the coloring material has been increased. Drying time of such coloring material using the water-type solvent or the alcohols solvent is longer than that of the coloring material using the quick-dry solvent.

[0014] In the coloring apparatus disclosed in Patent Document 1, while the electric wire cutting machine moves the electric wire, the spouting unit spouts to deposit the coloring material onto the outer surface of the electric wire. Therefore, if the solvent of the coloring material is the water-type or alcohols solvent, before the coloring material is fully dried, the electric wire contacts peripheral members, and the not-dried coloring material may adhere on such as a roller for moving the electric wire and may be removed from the electric wire. Resultingly, the coloring material deposited on the electric wire may be uneven, or partially removed, and the coloring material adhering on the roller may be deposited again on the outer surface of the electric wire. Accordingly, there is a problem that because the coloring pattern of the electric wire is different from the predetermined pattern, identifying the electric wire becomes difficult.

[0015] Further, in the coloring apparatus disclosed in Patent Document 2, when changing a shape or a layout of the coloring pattern, it is necessary to change a shape of the dimple or a layout of the coloring roller. Resultingly, there is a problem that because it is necessary to prepare another coloring roller, and to change the coloring roller, a cost and manpower are increased. There is also a problem that when changing the color of the coloring pattern, the coloring liquid in the tank should be changed, and manpower is increased.

[0016] An object of the present invention is to solve these problems. Namely, an object of the present invention is to provide an apparatus and a method for coloring an electric wire whereby the coloring material is quickly dried and is prevented from dropping out from the outer surface of the electric wire to surely identify the electric wires, and the coloring pattern is easily changed.

Means for solving problem

[0017] For attaining the object, according to claim 1 of the present invention, there is provided an apparatus for coloring an outer surface of an electric wire moving in one direction including:

a roller member of which outer peripheral wall contacts the outer surface of the electric wire, and rotates as the electric wire moves; and

a spouting unit for spouting coloring material onto the outer peripheral wall of the roller member.

[0018] According to claim 2 of the present invention, there is provided the apparatus for coloring the electric wire as claimed in claim 1,

wherein a plurality of spouting units are provided for spouting coloring material of which colors are different from each other onto the outer peripheral wall of the roller member.

[0019] According to claim 3 of the present invention, there is provided the apparatus for coloring the electric wire as claimed in claim 2,

wherein the spouting units are arranged in a circumferential direction of the roller member.

[0020] According to claim 4 of the present invention, there is provided the apparatus for coloring the electric wire as claimed in any one of claims 1 to 3,

wherein a groove arranged in the circumferential direction is formed on the outer peripheral wall of the roller member.

[0021] According to claim 5 of the present invention, there is provided the apparatus for coloring the electric wire as claimed in claim 4,

wherein a plurality of the grooves are arranged perpendicular to a longitudinal direction of the electric wire, and wherein a moving unit is provided for moving the roller member perpendicular to the longitudinal direction so that respective grooves are moved close to and moved away from the corresponding spouting units.

[0022] According to claim 6 of the present invention, there is provided a method for coloring an outer surface of an electric wire moving in one direction including the steps of

spouting coloring material onto an outer peripheral wall of a roller member;

rotating the roller member while the outer peripheral wall of the roller member contacts the outer surface of the electric wire as the electric wire is moved; and

rubbing the coloring material onto the outer surface of the electric wire to color the electric wire.

Effect of the invention

[0023] According to the invention as claimed in claim 1, the apparatus includes: the roller member of which outer peripheral wall contacts the outer surface of the electric wire, and disposed rotatably as the electric wire moves; and the spouting unit for spouting coloring material onto the outer peripheral wall of the roller member. Therefore, when the roller member is rotated, the coloring material is rubbed onto the outer surface of the electric wire, and the coloring material disposed on the outer surface of the electric wire is extended in a very thin uniform film shape, thereby the outer surface of the electric wire is colored. Therefore, the drying time of the coloring unit is drastically reduced, and the coloring agent having the water-type or alcohols solvent can be used instead of the quick-dry solvent such as toluene. Thus, an environmentally friendly electric wire can be produced.

[0024] Further, conventionally, when using the coloring material having the water-type or alcohols solvent, for drying quickly the coloring material, a plurality of spouting units spouting the same color at the same time is provided, and a drop spouted from the spouting unit is miniaturized. However, according to the present invention, the drying time is drastically reduced with one spouting unit and the roller member. Therefore, the number of the spouting units can be reduced and the cost can be reduced. Further, it is unnecessary to provide a drying device for drying the coloring material, and the apparatus for coloring an electric wire can be downsized.

[0025] According to the present invention as claimed in claim 2, a plurality of spouting units are provided for spouting coloring material of which colors are different from each other onto the outer peripheral wall of the roller member. Therefore, the color of the coloring pattern can be changed only by selecting and driving the spouting unit spouting the coloring material having a desired color among the spouting units. Therefore, manpower for an operation of changing the color is drastically reduced, and the time for the operation of changing the color is drastically reduced. Thus, the coloring of the electric wire can be performed continuously.

[0026] According to the present invention as claimed in claim 3, the spouting units are arranged in a circumferential direction of the roller member. Therefore, every spouting unit can be equally moved near the roller mem-

ber. Therefore, every spouting unit can surely spout the coloring material onto the outer surface of the roller member..

[0027] According to the present invention as claimed in claim 4, a groove arranged in the circumferential direction is formed on the outer peripheral wall of the roller member. Therefore, the spouting unit spouts the coloring material into the groove, and the electric wire is arranged in the groove. Thereby, the coloring material surely contacts the electric wire to surely color the electric wire. Further, by spouting the coloring material into the groove, the coloring material is not spouted onto a part of the roller member where the electric wire does not contact. Therefore, an amount of useless coloring material is reduced.

[0028] According to the present invention as claimed in claim 5, a plurality of the grooves are arranged perpendicular to a longitudinal direction of the electric wire, and the moving unit is provided for moving the roller member perpendicular to the longitudinal direction so as to respective grooves are moved close to and moved away from the corresponding spouting units. Therefore, each groove is easily moved close to and away from the corresponding spouting unit, and each spouting unit surely spouts the coloring material into the corresponding groove.

[0029] According to the present invention as claimed in claim 6, the method includes the steps of spouting coloring material onto an outer peripheral wall of a roller member; rotating the roller member while the outer peripheral wall of the roller member contacts the outer surface of the electric wire as the electric wire is moved; and rubbing the coloring material onto the outer surface of the electric wire to color the electric wire. Therefore, the coloring material on the outer surface of the electric wire is extended in a very thin uniform film shape to color the electric wire. Therefore, the drying time of the coloring unit is drastically reduced, and the coloring agent having the water-type or alcohols solvent can be used instead of the quick-dry solvent such as toluene. Thus, an environmentally friendly electric wire can be produced.

[0030] Further, conventionally, when using the coloring material having the water-type or alcohols solvent, for drying quickly the coloring material, a plurality of spouting units spouting the same color at the same time is provided, and a drop spouted from the spouting unit is miniaturized. However, according to the present invention, the drying time is drastically reduced with one spouting unit. Therefore, the number of the spouting units can be reduced and the cost can be reduced. Further, it is unnecessary to provide a drying device for drying the coloring material, and the apparatus for coloring an electric wire can be downsized.

Brief description of drawings

[0031]

[Fig. 1] An explanatory view showing a structure of an electric wire cutting machine on which an apparatus for coloring an electric wire according to an embodiment of the present invention is installed.

[Fig. 2] An enlarged explanatory view showing around a roller member of the apparatus for coloring an electric wire shown in Fig. 1.

[Fig. 3] A perspective view showing around the roller member of the apparatus for coloring an electric wire shown in Fig. 2.

[Fig. 4] A side view showing a positional relationship between an electric wire and the roller member when the apparatus for coloring an electric wire shown in Fig. 3 is operated.

[Fig. 5] A front view showing the electric wire and the roller member shown in Fig. 4

[Fig. 6] A top view showing the electric wire shown in Fig. 5 which is colored.

[Fig. 7] An explanatory view showing structures of spouting units of the apparatus for coloring an electric wire shown in Fig. 1.

[Fig. 8] An explanatory view showing a structure of a control unit of the apparatus for coloring an electric wire shown in Fig. 1.

[Fig. 9] A modified example of the colored electric wire shown in Fig. 6. Explanations of letters or numerals

[0032]

1	Apparatus for coloring an electric wire
5	Electric wire
5a	Outer surface of the electric wire
10	Electric wire cutting machine
31	Roller member
31a	Outer peripheral wall of the roller member
32	Linear guide (moving unit)
34	Encoder (detecting unit)
35c	Valve selecting circuit (memorizing unit, control unit)
36A to 36L	First to twelfth groove
40A to 40L	First to twelfth spouting unit
P	Moving direction of electric wire

Best mode for carrying out the invention

[0033] Hereafter, an apparatus for coloring an electric wire (hereafter simply referred to as "coloring apparatus") according to an embodiment of the present invention will be explained with reference to Figs. 1 to 9. The coloring apparatus 1 according to the embodiment of the present invention is installed on an electric wire cutting machine 10. The electric wire cutting machine 10 cuts an electric wire 5 in a specific length. The coloring apparatus 1 colors the outer surface 5a of the electric wire 5 by forming a mark 6 on a part of the outer surface 5a of the electric wire 5.

[0034] As shown in Fig. 1, the electric wire cutting ma-

chine 10 includes: a frame 11 as a main body of the cutting machine; a guide roll 12; a delivery roll 13 as an electric wire delivering unit; a correction unit 14 as a tension adding unit; and a slack absorbing unit 20; and a cutting unit 15.

[0035] The frame 11 is installed on a floor in a factory. The frame 11 is extended horizontally. The guide roll 12 is rotatably attached to an end of the frame 11. A long electric wire 5 not having a mark 6 is wound on the guide roll 12. The guide roll 12 sends the electric wire 5 into the correction unit 14, the slack absorbing unit 20, later-described spouting units 40A to 40L, a later-described encoder 34, and the cutting unit 15 sequentially.

[0036] A pair of delivery rolls 13 is provided at the other end of the frame 11. The pair of delivery rolls is rotatably supported by the frame 11, and arranged vertically. The delivery rolls 13 are rotated in directions opposite to each other in the same speed by a not-shown motor. The pair of delivery roll 13 catches the electric wire 5 therebetween, and pulls the electric wire 5 from the guide roll 12 in a longitudinal direction of the electric wire 5.

[0037] The delivery roll 13 having the above-described structure works as a pulling unit to pull the electric wire 5 in the longitudinal direction of the electric wire 5. When the delivery roll 13 moves the electric wire 5 in the longitudinal direction of the electric wire 5, the electric wire 5 is moved relative to a later-described roller member 31 in the longitudinal direction of the electric wire 5. The electric wire 5 is moved from the guide roll 12 to the delivery roll 13 in an arrow P direction of Fig. 1. The arrow P indicates the moving direction P of the electric wire 5.

[0038] The correction unit 14 is provided at the delivery roll 13 side of the guide roll 12, namely, provided in between the guide roll 12 and the delivery roll 13. Namely, the correction unit 14 is provided downstream of the guide roll 12 in the moving direction P of the electric wire 5, and provided upstream of the delivery roll 13 in the moving direction P of the electric wire 5. The correction unit 14 includes a plate-shaped unit main body 14a, a plurality of first rollers 14b, and a plurality of second rollers 14c. The unit main body 14a is fixed to the frame 11.

[0039] The first and second rollers 14b, 14c are respectively rotatably supported by the unit main body 14a. The plurality of first rollers 14b are arranged in the moving direction P of the electric wire 5, and disposed over the electric wire 5. The plurality of second rollers 14c are arranged in the moving direction P of the electric wire 5, and disposed under the electric wire 5. The first and second rollers 14b, 14c are arranged in a stagger shape.

[0040] The correction unit 14 having the above described structure catches the electric wire 5 sent from the guide roll 12 by the delivery roll 13 between the first rollers 14b and the second rollers 14c. Then, the correction unit 14 gives frictional force to the electric wire 5 caused by catching the electric wire 5 between the first and second rollers 14b, 14c. Namely, the correction unit 14 gives the electric wire 5 the frictional force as the first urging force Q1 in a direction opposed to the pulling di-

rection of the electric wire 5 by the delivery roll 13 (moving direction P of the electric wire 5). This urging force Q1 is smaller than the pulling force of the electric wire 5 by the delivery roll 13. Therefore, the correction unit 14 gives the electric wire 5 tension in the longitudinal direction of the electric wire 5 and tightens the electric wire 5.

[0041] The slack absorbing unit 20 is provided at the delivery roll 13 side of the correction unit 14, and provided in between the correction unit 14 and the delivery roll 13. Namely, the slack absorbing unit 20 is provided downstream of the correction unit 14 in the moving direction P of the electric wire 5, and provided upstream of the delivery roll 13 in the moving direction P of the electric wire 5. Further, the slack absorbing unit 20 is provided in between the correction unit 14 and the later-described roller member 31.

[0042] The slack absorbing unit 20 includes a pair of frames for supporting guiding rollers 21, a pair of guiding rollers 22, a frame for supporting the moving roller 23, a moving roller 24, and an air cylinder 25.

[0043] The frames for supporting guiding rollers 21 are fixed to the frame 11. The frames for supporting guiding rollers 21 are extended vertically from the frame 11. The pair of frames for supporting guiding rollers 21 are arranged having a gap in the moving direction P of the electric wire 5.

[0044] The frames for supporting guiding rollers 21 rotatably support the pair of guiding rollers 22 respectively. The guiding rollers 22 are arranged under the electric wire 5. As outer peripheral walls of the guiding rollers 22 contact the electric wire 5, the pair of guiding rollers 22 guides the electric wire 5 so as not to drop out of the moving direction P. Thus, the guiding rollers 22 guide the moving direction of the electric wire 5.

[0045] The frame for supporting the moving roller 23 is fixed to the frame 11. The frame for supporting the moving roller 23 is extended vertically from the frame 11. The frame for supporting the moving roller 23 is interposed between the pair of frames for supporting guiding rollers 21.

[0046] The moving roller 24 is rotatably movably in a vertical direction supported by the frame for supporting the moving roller 23. The moving roller 24 is arranged over the electric wire 5, and interposed in the center between the pair of guiding rollers 22.

[0047] The air cylinder 25 includes a cylinder main body 25a, and an extendable rod 25b which is extendable and retractable from the cylinder main body 25a. The cylinder main body 25a is fixed to the frame for supporting the moving roller 23, and disposed over the electric wire 5. The extendable rod 25b is extended downward from the cylinder main body 25a. Namely, the extendable rod 25b is extended toward the electric wire 5. The moving roller 24 is attached to the extendable rod 25b.

[0048] When a pressurized gas is supplied to an inside of the cylinder main body 25a, the air cylinder 25 urges downward the extendable rod 25b, namely, the moving roller 24 with the second urging force Q2. Therefore, the

air cylinder 25 urges the moving roller 24 with the second urging force Q2 toward the electric wire 5. The second urging force Q2 is smaller than the first urging force Q1.

[0049] When a pair of cutting blades 15a of the later-described cutting unit 15 is moved close to each other, and the movement of the electric wire 5 is once stopped for cutting the electric wire 5, the electric wire 5 is moved along the arrow P owing to inertia, and the electric wire 5 goes slack in between the pair of guiding rollers 22. Then, in the slack absorbing unit 20, the extendable rod 25b of the air cylinder 25 is extended, and the moving roller 24 is moved downward (as shown by a chain line in Fig. 1). Then, the slack absorbing unit 20 urges the electric wire 5 which is slack in between the guiding rollers 22 with the second urging force Q2 in the vertical direction to absorb the slack, and keeps the electric wire 5 tense.

[0050] The cutting unit 15 is disposed downstream of a pair of rotors 34a of the later-described encoder 34 of the coloring apparatus 1 in the moving direction P of the electric wire 5. The cutting unit 15 includes a pair of blades 15a. The pair of blades 15a is arranged vertically. The pair of blades 15a is moved close to and away from each other in the vertical direction. When the pair of blades 15a is moved close to each other, the pair of blades 15a catches and cuts the electric wire 5 sent from the pair of delivery rolls 13. When the pair of blades 15a moves away from each other, the pair of blades 15a moves away from the electric wire 5.

[0051] While the pair of blades 15a of the cutting unit 15 is moved away from each other, the electric wire cutting machine 10 catches the electric wire 5 with the pair of delivery rolls 13, and sends the electric wire 5 along the arrow P. Then, after a specific length of the electric wire 5 is sent, the delivery rolls 13 stop. Then, the pair of blades 15a is moved close to each other, catches and cuts the electric wire 5. Thus, the electric wire cutting machine 10 cuts the electric wire 5 after moving the electric wire 5 along the arrow P.

[0052] The coloring apparatus 1 colors the outer surface 5a of the electric wire 5 which is moved along the arrow P. The electric wire 5 constitutes a wiring harness to be mounted on a motor vehicle or the like as a mobile unit.

[0053] As shown in Fig. 5, the electric wire 5 includes an electrically conductive core wire 51 and an electrically insulating coating 52. A plurality of element wires 51a are bundled up to form the core wire 51. Each element wire 51a of the core wire 51 is made of electrically conductive metal. The core wire 51 may be constituted by a single element wire. The coating 52 is made of synthetic resin such as polyvinyl chloride. The coating 52 coats the core wire 51. Therefore, an outer surface of the coating 52 is the outer surface 5a of the electric wire 5.

[0054] The coating 52 has a monochrome color N (indicated by white in Fig. 6). A desired coloring agent may be mixed with the synthetic resin of the coating 52 so as to make the color of the outer surface 5a of the electric wire 5 be a monochrome color, or alternatively, the mon-

ochrome color N may be set as the color of the synthetic resin itself without adding a coloring agent to the synthetic resin of the coating 52. In the latter case when the monochrome color N is a color of the synthetic resin itself, the outer surface 5a of the electric wire 5 is called not colored. Thus, "not colored" means the outer surface 5a of the electric wire 5 is a color of the synthetic resin itself without mixing the coloring agent with the synthetic resin of the coating 52.

[0055] When the coloring apparatus 1 colors the outer surface 5a of the electric wire 5, a mark 6 such as shown in Fig. 6 is formed on the outer surface 5a of the electric wire 5. The color of the mark 6 is the first color A (shown by parallel slant lines in Fig. 6). The first color A is different from the monochrome color N. A planar shape of the mark 6 is substantially a round corner square shape along the longitudinal direction of the electric wire 5 (moving direction P of the electric wire 5). The shape and the arrangement (position on the electric wire 5) of the mark 6 are decided according to a predetermined pattern.

[0056] After the electric wire cutting machine 10 cuts the electric wire 5 in a specific length, a plurality of the electric wire 5 are bundled and a connector is attached to ends thereof to form the wiring harness. Then, this connector is connected to the connectors of various electronic components on a vehicle or the like, and the wiring harness, namely, the electric wire 5 transmits various signals and the electric power to the electronic components.

[0057] Further, when the first color A of the mark 6 is changed to various colors (in this embodiment, any one of the second to the twelfth colors B to L), the electric wires 5 can be identified from each other. The first to the twelfth colors A to L are different from each other. The color of the mark 6 is used as an identifier of the wire type of the wiring harness, or a system. Namely, the first to the twelfth colors A to L of the mark 6 of the electric wire 5 are used for identifying the purpose of use of each electric wire 5 of the wiring harness.

[0058] As shown in Fig. 1, the coloring apparatus 1 forms the mark 6 on the outer surface 5a of the electric wire 5. The coloring apparatus 1 is disposed at the delivery roll 13 side of the slack absorbing unit 20, and interposed between the slack absorbing unit 20 and the delivery roll 13. Namely, the coloring apparatus 1 is disposed downstream of the slack absorbing unit 20 in the moving direction P of the electric wire 5, and disposed upstream of the delivery roll 13 in the moving direction P of the electric wire 5.

[0059] As shown in Figs. 2 and 3, the coloring apparatus 1 includes a supporting frame 30, a roller member 31, a linear guide 32 as a moving unit, an air cylinder 33, the first to the twelfth spouting units 40A to 40L (partially shown in Fig. 3), an encoder 34 (Fig. 1) as a detecting unit, and a control unit 35 (Fig. 1). The supporting frame 30 is fixed to the frame 11. The supporting frame 30 is extended upward from the frame 11.

[0060] The roller member 31 is disposed over the elec-

tric wire 5, and disposed perpendicular to the longitudinal direction of the electric wire 5. As shown in Fig. 3, the roller member 31 includes a shaft center 31b, a roller 31c, and the first to the twelfth grooves 36A to 36L. The shaft center 31b is made of ceramic or the like, and formed in a cylinder shape. An end of the shaft center 31b in a longitudinal direction thereof is fitted into a bearing 32c formed on a later-described slider 32b of the linear guide 32, and rotatably supported by the slider 32b. Thus, the roller member 31 is supported rotatably.

[0061] The roller 31c is made of such as ceramic, and formed in a hollow cylinder shape. The roller 31c is disposed at an outside of the shaft center 31b. Therefore, an outer peripheral wall of the roller 31c is an outer peripheral wall 31a of the roller member 31. The above-described one end of the shaft center 31b is projected from one end of the roller 31c in the longitudinal direction thereof. The other end of the shaft center 31b is disposed at an inside of the roller 31c.

[0062] The first to the twelfth grooves 36A to 36L are grooves on the outer peripheral wall 31a of the roller 31c, namely, roller member 31, and formed in an entire length in a circumferential direction of the roller member 31. The grooves 36A to 36L are arranged along the longitudinal direction of the roller member 31, having a gap between each other. Namely, the grooves 36A to 36L are arranged parallel along a direction perpendicular to the longitudinal direction of the electric wire 5. The first to twelfth grooves 36A to 36L respectively correspond to the first to twelfth spouting units 40A to 40L. The number of the grooves is the same as the number of the spouting units (twelve). Any one of the spouting units 40A to 40L spouts the coloring material into an inside of corresponding groove of the grooves 36A to 36L. Further, a size of each groove of the grooves 36A to 36L is allowed to receive the electric wire 5, and the electric wire 5 is received in an inside of the groove.

[0063] The roller member 31 having the above-described structure is movably supported in the vertical direction. As shown in Fig. 4, when the coloring apparatus 1 operates for forming the mark 6, the roller member 31 in the vertical direction is moved so that a rear bottom wall 36a (shown by a dotted line in Fig. 4) of the first groove 36A near the electric wire 5 is lower than the outer surface 5a (shown by a chain line in Fig. 4) of the electric wire 5 near the roller member 31. Thus, the rear bottom wall 36a of the first groove 36A at the electric wire 5 side pushes downward the outer surface 5a of the electric wire 5 at the roller member 31 side in the vertical direction. Then, the outer surface 5a of the electric wire 5 shown by the chain line in Fig. 4 is pushed down to a position shown by a two-dot chain line in Fig. 4.

[0064] That is, the rear bottom wall 36a of the first groove 36A, namely, the outer peripheral wall 31a of the roller member 31 contacts the outer surface 5a of the electric wire 5 in the vertical direction. Then, the roller member 31 positioned at the position shown in Fig. 4 is rotatably supported about the shaft center 31b in an arrow

direction R as the movement of the electric wire 5 along the arrow P.

[0065] Further, the roller member 31 is supported movably in the horizontal direction. When the coloring apparatus 1 operates to form the mark 6, the roller member 31 is horizontally so positioned that the first groove 36A receives the electric wire 5 as shown in Fig. 5.

[0066] As shown in Fig. 3, the linear guide 32 includes a rail 32a and a slider 32b. The rail 32a is formed in a straight shape. The rail 32a is disposed horizontally, and perpendicular to the longitudinal direction of the electric wire 5. The rail 32a is supported movably in the vertical direction by the supporting frame 30. The slider 32b is supported movably by the rail 32a in a longitudinal direction of the rail 32a. The slider 32 is moved in the longitudinal direction of the rail 32a by a not-shown driving source such as a motor. The roller member 31 is attached to the slider 32b.

[0067] When the slider 32b is moved in the longitudinal direction of the rail 32a, the linear guide 32 having the above-described structure moves the roller member 31 in the longitudinal direction of the rail 32a, namely, perpendicular to the longitudinal direction of the electric wire 5. Then, when the roller member 31 is moved in a direction perpendicular to the longitudinal direction of the electric wire 5, the linear guide 32 respectively moves the grooves 36A to 36L close to or away from the corresponding spouting units 40A to 40L.

[0068] The air cylinder 33 includes a cylinder main body 33a, and an extendable rod 33b extendable and retractable from the cylinder main body 33a. The cylinder main body 33a is fixed to the frame 11, and disposed under the electric wire 5. The extendable rod 33b is extended in a direction where the electric wire 5 is moved away from the cylinder main body 33a. The rail 32a of the linear guide 32 is attached to the extendable rod 33b.

[0069] When the extendable rod 33b is extended or retracted, the air cylinder 33 having the above-described structure moves the linear guide 32 close to or away from the electric wire 5 in the vertical direction. Because the roller member 31 is attached to the slider 32b of the linear guide 32, when the extendable rod 33b is extended or retracted, the air cylinder 33 moves the roller member 31 close to or away from the electric wire 5 in the vertical direction.

[0070] As shown in Figs. 2 and 3, the first to twelfth spouting units 40A to 40L are arranged in the moving direction of the electric wire 5, and arranged in the circumferential direction of the roller member 31 in a radial pattern. The spouting units 40A to 40L are attached to a spouting unit holder (not shown) fixed to the frame 11. The spouting units 40A to 40L are disposed at the delivery roll 13 side of the slack absorbing unit 20, and interposed between the slack absorbing unit 20 and the delivery roll 13. Namely, the spouting unit 40A to 40L are disposed downstream of the slack absorbing unit 20 in the moving direction P of the electric wire 5, and disposed upstream of the delivery roll 13 in the moving direction P of the

electric wire 5.

[0071] These first to twelfth spouting units 40A to 40L can respectively spout the first to twelfth coloring materials onto the outer peripheral wall 31a of the roller member 31. The first to twelfth coloring materials are respectively include the first to twelfth colors A to L. The first to twelfth colors A to L are different from each other. Because the structures of the first to the twelfth spouting unit 40A to 40L are substantially the same, hereafter the first spouting unit 40A will be explained on behalf of all the spouting units.

[0072] The first spouting unit 40A includes a first nozzle 41A and a first valve 42A. As shown in Fig. 3, the first nozzle 41A faces the outer peripheral wall 31a of the roller member 31. The first nozzle 41A has a hole through which the first coloring material having the first color A flows. The hole is extended straight toward the outer peripheral wall 31a of the roller member 31. An opening of the hole faces the outer peripheral wall 31a of the roller member 31, and an inside of which the first coloring material can flow. A first coloring material supplying source 43A is connected to the first nozzle 41A. The first coloring material supplying source 43A supplies the first coloring material to the hole.

[0073] As shown in Fig. 7, the first valve 42A is interposed between the first nozzle 41A and the first coloring material supplying source 43A, and connected to them. A pressurized gas supplying source 45 is further connected to the first coloring material supplying source 43A. The pressurized gas supplying source 45 supplies a pressurized gas to an inside of the first coloring material supplying source 43A. Incidentally, this pressurized gas supplying source 45 is also connected to the second to twelfth coloring material supplying sources 43B to 43L, and supplies the pressurized gas to insides of the second to twelfth coloring material supplying sources 43B to 43L.

[0074] When the first valve 42A is open, the pressurized gas supplied from the pressurized gas supplying source 45 spouts the first coloring material in the hole of the first nozzle 41A via the opening to the outer peripheral wall 31a of the roller member 31. When the first valve 42A is closed, the spout of the first coloring material in the first nozzle 41A is stopped.

[0075] When the first valve 42A is open in predetermined time according to a signal from a later-described valve driving circuit 37 of the control unit, the first spouting unit 40A having the above-described structure spouts a specific amount of the first coloring material to the outer peripheral wall 31a of the roller member 31. Thus, the first spouting unit 40A spouts a specific amount of the first coloring material at once. Incidentally, spouting means that the liquid first coloring material is jetted toward the outer surface 5a of the electric wire 5 in a drop condition.

[0076] Similar to the above-described first spouting unit 40A, the second to twelfth spouting units 40B to 40L also can spout a specific amount of the second to twelfth coloring materials onto the outer peripheral wall 31a of

the roller member 31. The first to twelfth spouting units respectively correspond to the first to twelfth grooves 36A to 36L of the roller member 31. The openings of the spouting units 40A to 40L respectively face the corresponding grooves 36A to 36L when the linear guide 32 moves the roller member 31 in the horizontal direction. Then, the spouting units 40A to 40L spout the first to twelfth coloring materials to the outer peripheral wall 31a of the roller member 31 to spout the first to twelfth coloring materials onto insides of the grooves 36A to 36L.

[0077] The above-described first to twelfth coloring materials means a liquid substance, in which a coloring agent (organic substance for use in industry) is dissolved and dispersed in a solvent. The coloring agent is a dye or a pigment (most of them are organic substances and synthetic substances). Sometimes, a dye is used as a pigment and a pigment is used as a dye. As the solvent, there is a quick-dry solvent such as toluene, and a slow-dry solvent such as water-type solvent or alcohols solvent. As a concrete example of the first to twelfth coloring materials, the coloring material may be a coloring liquid or coating material.

[0078] The coloring liquid is a liquid, in which a dye, as the coloring material, is dissolved or dispersed in a solvent. The coating material is a material, in which a pigment, as the coloring material, is dispersed in a liquid dispersion as the solvent. When the outer surface 5a of the electric wire 5 is colored with a coloring liquid, the dye permeates into the coating 52 of the electric wire 5. When the outer surface 5a of the electric wire 5 is colored with a coating material, the pigment adheres to the outer surface 5a without permeating into the coating 52 of the electric wire 5. Preferably, the solvent and liquid dispersion have an affinity to the synthetic resin that constitutes the coating 52 in order to securely permeate the dye into the coating 52 or to allow the pigment to securely adhere to the outer surface 5a of the electric wire 5.

[0079] Namely, the first to twelfth spouting units 40A to 40L dye a part of the outer surface 5a of the electric wire 5 with the dye, or coat a part of the outer surface 5a of the electric wire 5 with a pigment. Therefore, "to color the outer surface 5a of the electric wire 5" means to dye a part of the outer surface 5a of the electric wire 5 with a dye or to coat a part of the outer surface 5a of the electric wire 5 with a pigment.

[0080] As shown in Fig. 1, the encoder 34 includes a pair of rotors 34a. The rotor 34a is disposed downstream of the delivery roll 13 in the moving direction P of the electric wire 5. Each rotor 34a is supported rotatably around the axis of the rotor 34a. An outer peripheral wall of the rotor 34a contacts the outer surface 5a of the electric wire 5 which is caught between the pair of delivery rolls 13. The pair of rotors 34a catches the electric wire 5 therebetween. When the electric wire 5 is moved along the arrow P, each rotor 34a rotates. The number of rotations of the rotor 34a is proportional to the moving distance of the electric wire 5 along the arrow P.

[0081] This encoder 34 is connected to a later-de-

scribed pulse counting circuit 35b of the control unit 35. When the rotor 34a rotates by a specific angle, the encoder 34 outputs a pulse signal to the control unit 35. Namely, the encoder 34 measures data corresponding to the moving speed of the electric wire 5 along the arrow P and outputs the data to the pulse counting circuit 35b. Normally, the encoder 34 outputs a pulse signal corresponding to the moving distance of the electric wire 5 with the aid of the friction between the electric wire 5 and the rotor 34a. However, when the moving distance of the electric wire 5 does not correspond to the number of the pulse due to a condition of the outer surface 5a of the electric wire 5, another speed data of the electric wire 5 may be obtained from another position to feedback and the control unit 35 may compare the both.

[0082] As shown in Fig. 8, the control unit 35 includes a boxy unit main body 35a, the pulse counting circuit 35b, a valve selecting circuit 35c as a memory unit and a controller, and the first to twelfth valve driving circuits 37A to 37L. The unit main body 35a receives the pulse counting circuit 35b, the valve selecting circuit 35c, and the first to twelfth valve driving circuits 37A to 37L.

[0083] The pulse counting circuit 35b counts the pulse signal inputted from the encoder 34. The pulse counting circuit 35b is connected to the valve selecting circuit 35c, and outputs data indicating the number of the pulse signal inputted from the encoder to the valve selecting circuit 35c. For increasing the pulse resolution, the pulse counting circuit 35b may divide the very high frequency of the pulse signal generated by the encoder 34 and input the divided frequency into the pulse counting circuit 35b.

[0084] The valve selecting circuit 35c is connected to the valve driving circuits 37A to 37L. When predetermined ordered pulse signals are inputted, the valve selecting circuit 35c outputs a signal to make the valve driving circuits 37A to 37L open the valves 42A to 42L. According to the pattern of the mark 6 formed on the outer surface 5a of the electric wire 5, the valve selecting circuit 35c outputs a signal to make the valve driving circuits 37A to 37L open the valves 42A to 42L.

[0085] Namely, the valve selecting circuit 35c memorizes to open any one of valves 42A to 42L or to close all with respect to each pulse signal inputted from the encoder 34. According to this memorized pattern, the valve selecting circuit 35c controls the valve driving circuits 37A to 37L. Incidentally, when the pulse counting circuit 35b is directly connected to the valve driving circuits 37A to 37L, the valve selecting circuit 35c can be omitted.

[0086] Thus, the valve selecting circuit 35c previously memorizes the pattern to coloring the outer surface 5a of the electric wire 5. Further, in response to the moving speed of the electric wire 5 inputted from the encoder 34, the valve selecting circuit 35c can make the spouting units 40A to 40L spout the first to twelfth coloring material onto the outer surface 5a of the electric wire 5 in a specific amount in accordance with the memorized pattern. The above-described pulse counting circuit 35b and the valve selecting circuit 35c are made of well-known digital cir-

cuits.

[0087] The number of the valve driving circuits 37A to 37L is the same as the number of the spouting units 40A to 40L, and the valve driving circuits 37A to 37L respectively correspond to the spouting units 40A to 40L. The valves 42A to 42L of the spouting units 40A to 40L are connected to corresponding valve driving circuits 37A to 37L via a not-shown interface. When the valve selecting circuit 35c inputs the signal to open the valves 42A to 42L, the valve driving circuits 37A to 37L outputs the open signal to the valves 42A to 42L. When the valve driving circuits 37A to 37L outputs the signal to open the corresponding valves 42A to 42L to the valves 42A to 42L, the corresponding valves 42A to 42L are open. Thus, when outputting the signal to the valves 42A to 42L, the valve driving circuits 37A to 37L controls the open/close of the corresponding valves 42A to 42L.

[0088] When the coloring apparatus 1 having the above-described structure forms the mark 6 on the outer surface 5a of the electric wire 5, namely, colors the outer surface 5a of the electric wire 5, firstly, the guide roll 12 is attached to the frame 11. The pair of cutting blades 15a is moved away from each other, and the electric wire 5 wound on the guide roll 12 is passed through the correction unit 14, the slack absorbing unit 20, and the coloring apparatus 1 sequentially, and caught between the pair of delivery rolls 13. Then, the coloring material supplying sources 43A to 43L corresponding to the spouting units 40A to 40L are connected to the coloring apparatus 1. Then, the pressurized gas supplying source 45 is connected to the coloring material supplying sources 43A to 43L.

[0089] Then, the extendable rod 33b of the air cylinder 33 is extended and moves the roller member 31 upward to position the roller member 31 away from the electric wire 5. Next, the slider 32b of the linear guide 32 is moved to move the roller member 31 perpendicular to the longitudinal direction of the electric wire 5. Then, the opening of the hole of the first nozzle 41A of the first spouting unit 40A faces the corresponding groove 36A. Then, the extendable rod 25b of the air cylinder 25 is retracted to move the roller member 31 downward to position the electric wire 5 in the groove 36A and position the roller member 31 at the position to press the electric wire 5. Thus, the outer peripheral wall 31a of the roller member 31 presses (contacts) the outer surface 5a of the electric wire 5.

[0090] Then, the delivery rolls 13 are rotated to pull the electric wire 5 from the guide roll 12 in the longitudinal direction of the electric wire 5. Further, the correction unit 14 gives the electric wire 5 the first urging force Q1 to tense the electric wire 5. Then, the air cylinder 25 presses the moving roller 24, namely, the electric wire 5 with the second urging force Q2.

[0091] Then, when the predetermined ordered pulse signal is inputted from the encoder 34 to the pulse counting circuit, the first valve driving circuit 37A connected to the first valve 42A opens the first valve 42A once in a

specific time. Then, as shown in Fig. 5, the first spouting unit 40A spouts the first coloring material onto the inside of the corresponding groove 36A.

[0092] Then, as the electric wire 5 is moved, the roller member 31 is rotated along the arrow R and the first coloring material in the groove 36A is moved close to the electric wire 5. Then, the first coloring material is rubbed on the outer surface 5a of the electric wire 5. Thus, by rubbing the first coloring material on the outer surface 5a of the electric wire 5, the first coloring material is extended in a very thin uniform film shape.

[0093] Then, the solvent or the liquid dispersion evaporates from the first coloring material; thereby the outer surface 5a of the electric wire 5 is dyed with the dye or coated with the pigment. Because the first coloring material is extended in a very thin shape, even if the solvent or the liquid dispersion is slow-dry such as water-type or alcohols solvent, the solvent or the liquid dispersion rapidly evaporates, and the coloring material is quickly dried. Thus, as shown in Fig. 6, the mark 6 is formed on the outer surface 5a of the electric wire 5 moving along the arrow P, and the outer surface 5a of the electric wire 5 is colored.

[0094] When the control unit 35 judges that the specific length of the electric wire 5 is moved based on the data from the encoder 34, the control unit 35 stops the delivery rolls 13. Then, the electric wire 5 becomes slack especially in between the pair of guiding rollers 22 of the slack absorbing unit 20. Then, the extendable rod 25b of the air cylinder 25 of the slack absorbing unit 20 is extended, and the moving roller 24 urged by the second urging force Q2 is moved to a position shown by the dashed line in Fig. 1. Then, the slack absorbing unit 20 absorbs the slack of the electric wire 5. Then, the pair of cutting blades 15a is moved close to each other, catches the electric wire 5 therebetween, and cuts the electric wire 5. Thus, the electric wire 5 having the mark 6 with the first color A on the outer surface 5a is attained.

[0095] When the color of the mark 6 is changed from the first color A to the other color (for example, the second color B), while the delivery rolls 13 are stopped, the extendable rod 33b of the air cylinder 33 is extended to move the roller member 31 upward, namely, position the roller member 31 away from the electric wire 5. Next, the slider 32b of the linear guide 32 is moved to move the roller member 31 perpendicular to the longitudinal direction of the electric wire 5 so that the opening of the hole of the second nozzle 41B of the second spouting unit 40B faces the corresponding second groove 36B. Then, the extendable rod 33b of the air cylinder 33 is retracted to move the roller member 31 downward in the vertical direction so that the electric wire 5 is disposed in the second groove 36B and the roller member 31 pushes (contacts) the electric wire 5. Then, as described before, the delivery rolls 13 are rotated.

[0096] According to this embodiment, because the coloring apparatus 1 includes: the roller member 31 of which outer peripheral wall 31a contacts the outer sur-

face 5a of the electric wire 5 and rotates as the electric wire 5 is moved; and the first to twelfth spouting units for spouting the first to twelfth coloring material onto the outer peripheral wall 31a of the roller member 31, the coloring material is rubbed on the outer surface 5a of the electric wire 5 when the roller member 31 is rotated. Therefore, the coloring material on the outer surface 5a of the electric wire 5 is extended in a very thin uniform film shape and the outer surface 5a of the electric wire 5 is colored. Therefore, the drying time of the coloring material is drastically reduced, and the water-type or alcohols solvent can be used instead of the quick-dry solvent such as toluene. Thereby, the environmentally friendly electric wire can be produced.

[0097] Further, conventionally, when using the coloring material having the water-type or alcohols solvent, for drying quickly the coloring material, a plurality of spouting units spouting the same color A at the same time is provided, and a drop spouted from the spouting unit is miniaturized. However, according to the present invention, the drying time is drastically reduced with the first spouting unit 40A and the roller member 31. Therefore, the number of the spouting units can be reduced and the cost can be reduced. Further, it is unnecessary to provide a drying device for drying the coloring material, and the apparatus for coloring an electric wire 1 can be downsized.

[0098] The first to twelfth spouting units 40A to 40L are provided so that the first to twelfth coloring materials having the first to twelfth colors A to L different from each other can be spouted onto the outer peripheral wall 31a of the roller member 31. Therefore, the color of the coloring pattern can be changed only by selecting and driving the spouting unit spouting the coloring material having a desired color among the spouting units 40A to 40L. Therefore, manpower for an operation of changing the color is drastically reduced, and the time for the operation of changing the color is drastically reduced. Thus, the coloring of the electric wire 5 can be performed continuously.

[0099] The first to twelfth spouting units 40A to 40L are arranged in a circumferential direction of the roller member 31. Therefore, these spouting units 40A to 40L can be equally moved near the roller member 31. Therefore, the spouting units 40A to 40L can surely spout the coloring material onto the outer surface 31a of the roller member 31.

[0100] The first to twelfth grooves 36A to 36L arranged in the circumferential direction of the roller member 31 is formed on the outer peripheral wall of the roller member 31. Therefore, the coloring material is spouted into the inside of the first to twelfth grooves 36A to 36L, and the electric wire 5 is arranged in the first to twelfth grooves 36A to 36L. Thereby, the coloring material surely contacts the electric wire 5 to surely color the electric wire 5. Further, by spouting the coloring material into the groove 36, the coloring material is not spouted onto a part of the roller member 31 where the electric wire 5

does not contact. Therefore, an amount of useless coloring material is reduced.

[0101] The first to twelfth grooves 36A to 36L are arranged perpendicular to a longitudinal direction of the electric wire 5, and the roller member is moved perpendicular to the longitudinal direction of the electric wire 5 so as to respective grooves 36A to 36L are moved close to and moved away from the corresponding spouting units 40A to 40L with the linear guide 32. Therefore, the grooves 36A to 36L are easily moved close to and away from the corresponding spouting units 40A to 40L, and the spouting units 40A to 40L surely spouts the coloring material into the corresponding grooves 36A to 36L.

[0102] The coloring apparatus 1 includes: the encoder 34 for detecting the moving speed of the electric wire 5; and the valve selecting circuit 35c for storing the pattern of coloring the electric wire 5, and for making the first to twelfth spouting units 40A to 40L spout the coloring material onto the outer peripheral wall 31a of the roller member 31 according to the pattern in response to the moving speed of the electric wire 5 detected by the encoder 34. Therefore, the form and the arrangement of the colored pattern can be easily changed by only controlling the spouting units 40A to 40L without changing the roller member 31. Therefore, the electric wires 5 having different colored patterns can be easily produced.

[0103] Because the first to twelfth grooves 36A to 36L are provided corresponding to the first to twelfth spouting units 40A to 40L, the coloring material is only spouted onto the insides of the grooves 36A to 36L corresponding to the spouting units. Therefore, the coloring materials having different colors may not be mixed, and the electric wire 5 is surely colored with the desired color.

[0104] Because the first to twelfth spouting units 40A to 40L are arranged in the moving direction of the electric wire 5, the coloring apparatus 1 can be miniaturized in a direction perpendicular to the moving direction P of the electric wire 5.

[0105] Because the coloring apparatus 1 is installed on the electric wire cutting machine 10 for cutting the electric wire 5 after moving the electric wire 5 along the arrow P, when the long electric wire 5 is cut in a specific length, the electric wire 5 can be colored with a desired color. Thereby, a space for installing the machine can be reduced, and the man-hour for processing the electric wire 5 can be reduced.

[0106] In this embodiment, only one mark 6 having substantially a round corner square shape is formed. However, according to the present invention, the mark 6 is not limited to this, and the mark 6 may have various shapes. For example, the first nozzle 41A opens three times in a specific time and the first coloring material is spouted three times onto the inside of the groove 36, and rubbed on the electric wire 5. Thereby, as shown in Fig. 9, the mark 6 having a long line shape made by connecting these marks may be formed.

[0107] Further, in this embodiment, the numbers of the first to twelfth spouting units 40A to 40L and the first to

twelfth grooves 36A to 36L are each twelve. However, according to the present invention, the number of the spouting units 40 and the number of the grooves 36 are not limited.

[0108] Further, in this embodiment, the control unit 35 is mainly made of the digital circuits. However, according to the present invention, the control unit 35 may be made of a computer having well-known RAM, ROM, CPU and well-known non-volatile memory such as EEPROM. In this case, the non-volatile memory such as EEPROM works as the memory unit, and the CPU works as the controller.

[0109] Further, in this embodiment, the electric wire 5 is used for composing a wiring harness arranged in a vehicle. However, according to the present invention, the electric wire 5 may be used for various electronic components such as a computer, or for various electric machines.

[0110] In the present invention, as the coloring liquid or coating material, various material such as acrylic coating material, ink (dye or pigment) and UV-ink can be used.

[0111] Although the present invention has been fully described by way of example with reference to the accompanying drawings, it is to be understood that various changes and modifications will be apparent to those skilled in the art. Therefore, unless otherwise such changes and modifications depart from the scope of the present invention hereinafter defined, they should be construed as being included therein.

Claims

1. An apparatus for coloring an outer surface of an electric wire moving in one direction including:

a roller member of which outer peripheral wall contacts the outer surface of the electric wire, and rotates as the electric wire moves;

a spouting unit for spouting coloring material;

a slack absorbing unit having a moving roller and an air cylinder for absorbing the slack of the electric wire; and

a correction unit having a plurality of first rollers and a plurality of second rollers for giving the electric wire tension,

characterized in that the spouting unit spouts the coloring material into an inside of grooves formed onto the outer peripheral wall of the roller member, the grooves being respectively arranged in the circumferential direction of the roller member.

2. The apparatus for coloring the electric wire as claimed in claim 1, wherein a plurality of spouting units are provided for spouting coloring material of which colors are different from each other onto the outer peripheral wall of

the roller member.

3. The apparatus for coloring the electric wire as claimed in claim 2, wherein the spouting units are arranged in a circumferential direction of the roller member.
4. The apparatus for coloring the electric wire as claimed in claim 1, wherein a plurality of the grooves are arranged perpendicular to a longitudinal direction of the electric wire, and wherein a moving unit is provided for moving the roller member perpendicular to the longitudinal direction so that respective grooves are moved close to and moved away from the corresponding spouting units.
5. A method for coloring an outer surface of an electric wire moving in one direction including the steps of:

absorbing a slack of the electric wire;

giving the electric wire tension;

spouting coloring material;

rotating a roller member while an outer peripheral wall of the roller member contacts the outer surface of the electric wire as the electric wire is moved; and

rubbing the coloring material onto the outer surface of the electric wire to color the electric wire, **characterized in that** when spouting the coloring material, the coloring material is being spouted into an inside of grooves formed onto the outer peripheral wall of the roller member, the grooves being respectively arranged in the circumferential direction of the roller member.

Patentansprüche

1. Vorrichtung zum Färben einer Außenfläche von einem in eine Richtung bewegenden elektrischen Draht, umfassend:

ein Rollenglied, dessen Randaußenwand die Außenfläche des elektrischen Drahtes berührt und das sich dreht, als der elektrische Draht sich bewegt;

eine Spritzeinheit um Färbungsmittel zum spritzen;

eine Lockerungsaufnahmeeinheit, die eine bewegende Rolle und einen Druckluftzylinder zum Lockerungsaufnehmen des elektrischen Drahtes hat; und

eine Korrektureinheit, die eine Mehrzahl von ersten Rollen und eine Mehrzahl von zweiten Rollen, um die Spannung des elektrischen Drahtes zu gewährleisten, hat,

- dadurch gekennzeichnet, dass** die Spritzeinheit das Färbungsmittel in eine Innenseite von auf der Rollenglied-Randaußenwand gebildeten Nuten hinein spritzt, wobei die Nuten jeweils in der Umfangsrichtung des Rollengliedes angeordnet sind. 5
2. Vorrichtung zum Färben vom elektrischen Draht nach Anspruch 1, wobei eine Mehrzahl von Spritzeinheiten zum Spritzen von Färbungsmittel, dessen Farben sich von einander unterscheiden, auf der Randaußenwand des Rollengliedes vorgesehen sind. 10
3. Vorrichtung zum Färben vom elektrischen Draht nach Anspruch 2, wobei die Spritzeinheiten in einer Umfangsrichtung des Rollengliedes angeordnet sind. 15
4. Vorrichtung zum Färben vom elektrischen Draht nach Anspruch 1, wobei eine Mehrzahl der Nuten senkrecht zu einer Längsrichtung des elektrischen Drahtes angeordnet sind, und wobei eine bewegende Einheit zum Bewegen des Rollengliedes senkrecht zur Längsrichtung vorgesehen ist, um sich an die jeweiligen Nuten näher zu bewegen und aus der jeweiligen Spritzeinheiten weg zu bewegen. 20 25
5. Verfahren zum Färben einer Außenfläche von einem in eine Richtung bewegenden elektrischen Draht, wobei die Schritte eine Lockerung des elektrischen Drahtes aufzunehmen; die Spannung dem elektrischen Draht zu gewährleisten; Färbungsmittel zu spritzen; ein Rollenglied zu drehen, während eine Randaußenwand des Rollengliedes die Außenfläche des elektrischen Drahtes berührt, als der elektrische Draht bewegt wird; und das Färbungsmittel auf der Außenfläche des elektrischen Drahtes zum Färben des elektrischen Drahtes zu reiben, umfasst, **dadurch gekennzeichnet, dass** beim Spritzen des Färbungsmittels, das Färbungsmittel in eine Innenseite von auf der Rollenglied-Randaußenwand gebildeten Nuten hinein gespritzt wird, wobei die Nuten jeweils in der Umfangsrichtung des Rollengliedes angeordnet sind. 30 35 40 45

Revendications

1. Appareil pour colorer une surface extérieure d'un fil électrique se déplaçant vers une direction, comprenant: 50 55
- un élément à rouleaux, dont la paroi extérieure périphérique touche la surface extérieure du fil

électrique et tourne au fur et à mesure que le fil électrique se déplace;
une unité de jaillissement, pour faire jaillir de la matière colorante;
une unité d'absorption du relâchement ayant un rouleau mouvant et un cylindre à air pour absorber le relâchement du fil électrique; et
une unité à correction ayant une pluralité de premiers rouleaux et une pluralité de seconds rouleaux pour assurer que le fil électrique reste tendu,
caractérisé en ce que l'unité de jaillissement jaillit de la matière colorante vers l'intérieur de rainures formées sur la paroi extérieure périphérique de l'élément à rouleaux, les rainures étant disposées, respectivement, dans la direction circconférentielle de l'élément à rouleaux.

2. Appareil pour colorer le fil électrique selon la revendication 1, étant qu'une pluralité d'unités de jaillissement sont prévues pour faire jaillir de la matière colorante, dont les couleurs sont différentes les unes des autres, sur la paroi extérieure périphérique de l'élément à rouleaux.
3. Appareil pour colorer le fil électrique selon la revendication 2, étant que les unités de jaillissement sont disposées dans une direction circconférentielle de l'élément à rouleaux.
4. Appareil pour colorer le fil électrique selon la revendication 1, étant qu'une pluralité des rainures sont disposées perpendiculairement à une direction longitudinale du fil électrique, et étant qu'une unité mobile est prévue pour déplacer l'élément à rouleaux perpendiculairement à la direction longitudinale, de telle façon que les rainures respectives se rapprochent et s'éloignent des unités de jaillissement correspondantes.
5. Procédé pour colorer une surface extérieure d'un fil électrique se déplaçant dans une direction, comprenant les étapes de:

Absorber un relâchement du fil électrique;
assurer la tension du fil électrique;
faire jaillir de la matière colorante;
faire tourner un élément à rouleaux, pendant qu'une paroi extérieure périphérique touche la surface extérieure du fil électrique, au fur et à mesure que le fil électrique se déplace; et
frotter la matière colorante sur la surface extérieure du fil électrique, pour colorer le fil électrique,

caractérisé en ce que, lors du jaillissement de la matière colorante, la matière colorante est jaillie vers l'intérieur de rainures formées sur la paroi extérieure

périphérique de l'élément à rouleaux, les rainures étant disposées, respectivement, dans la direction circonférentielle de l'élément à rouleaux.

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FIG. 1

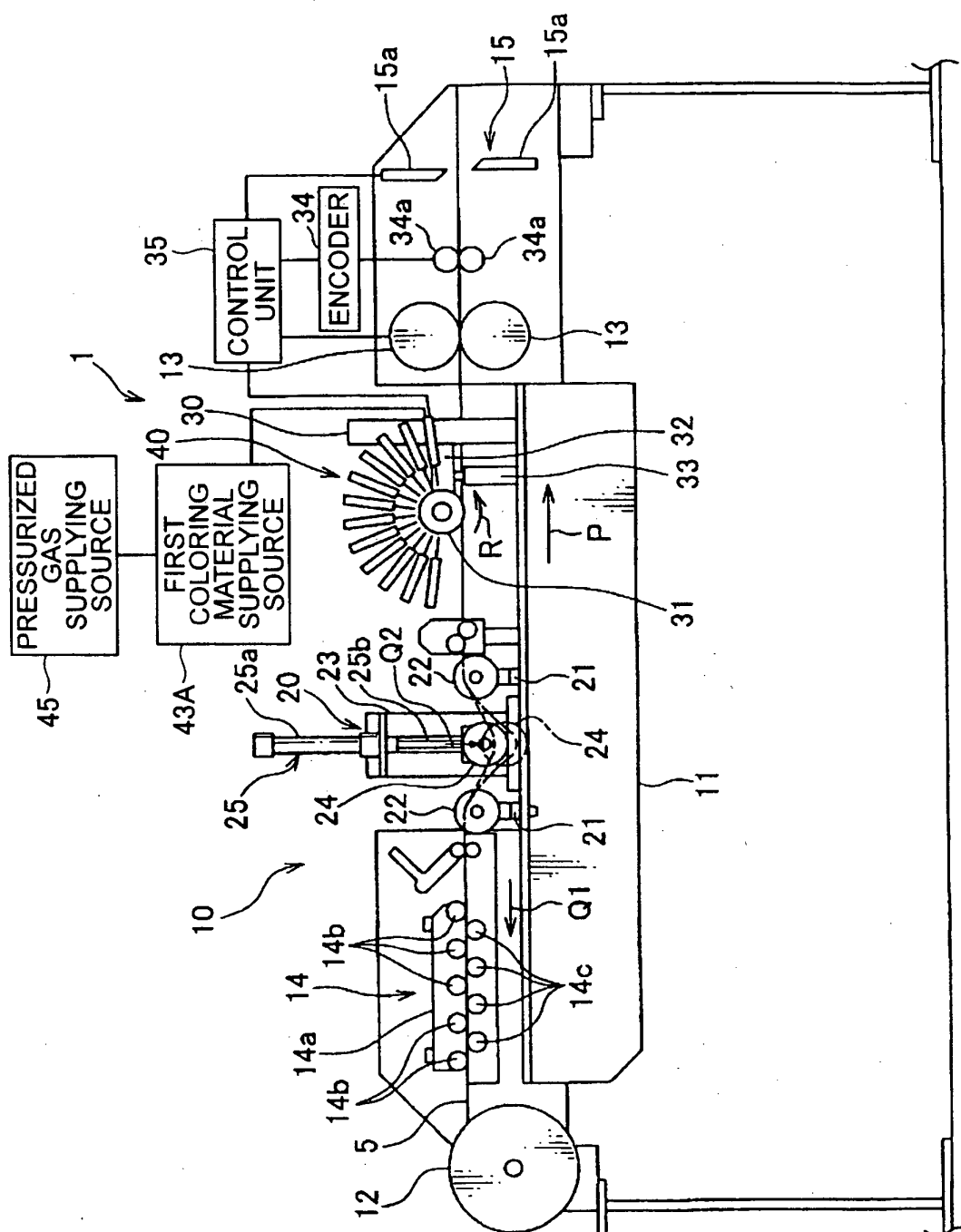


FIG. 2

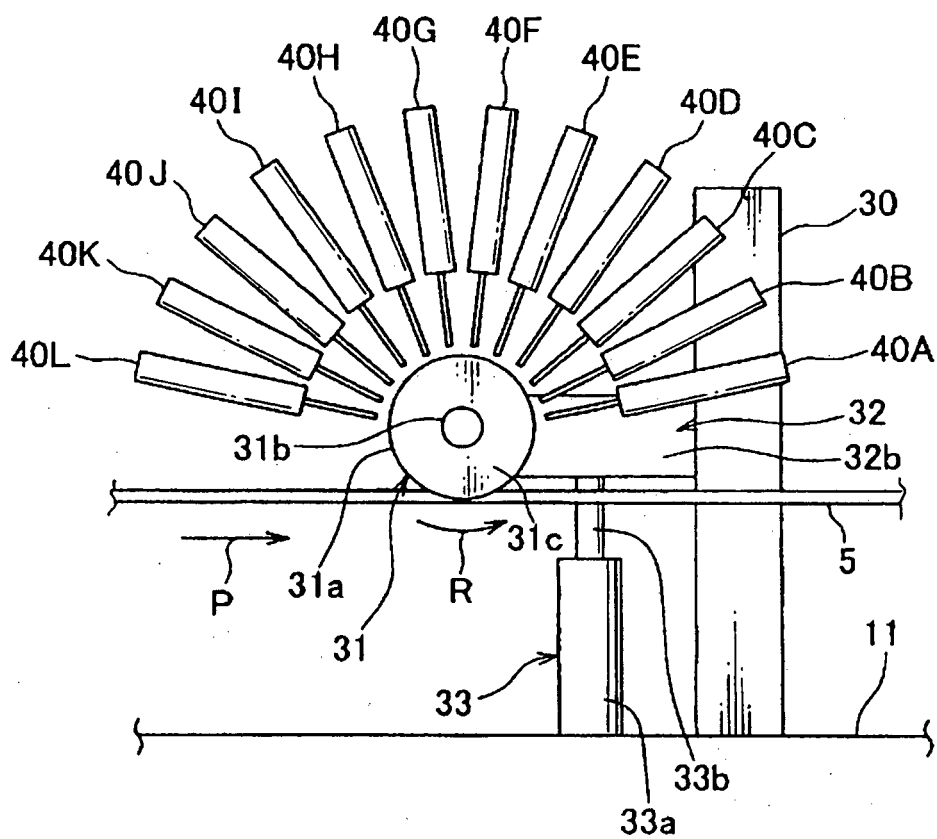


FIG. 3

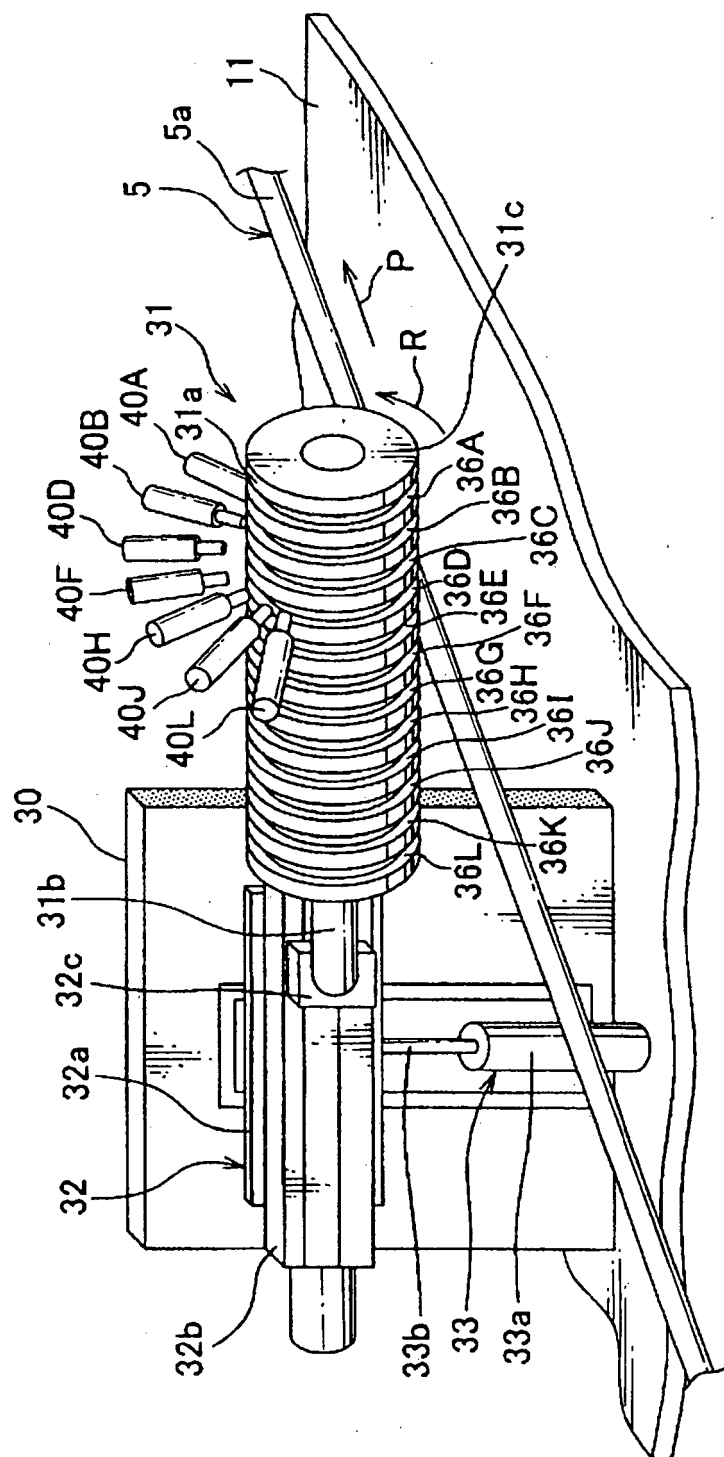


FIG. 4

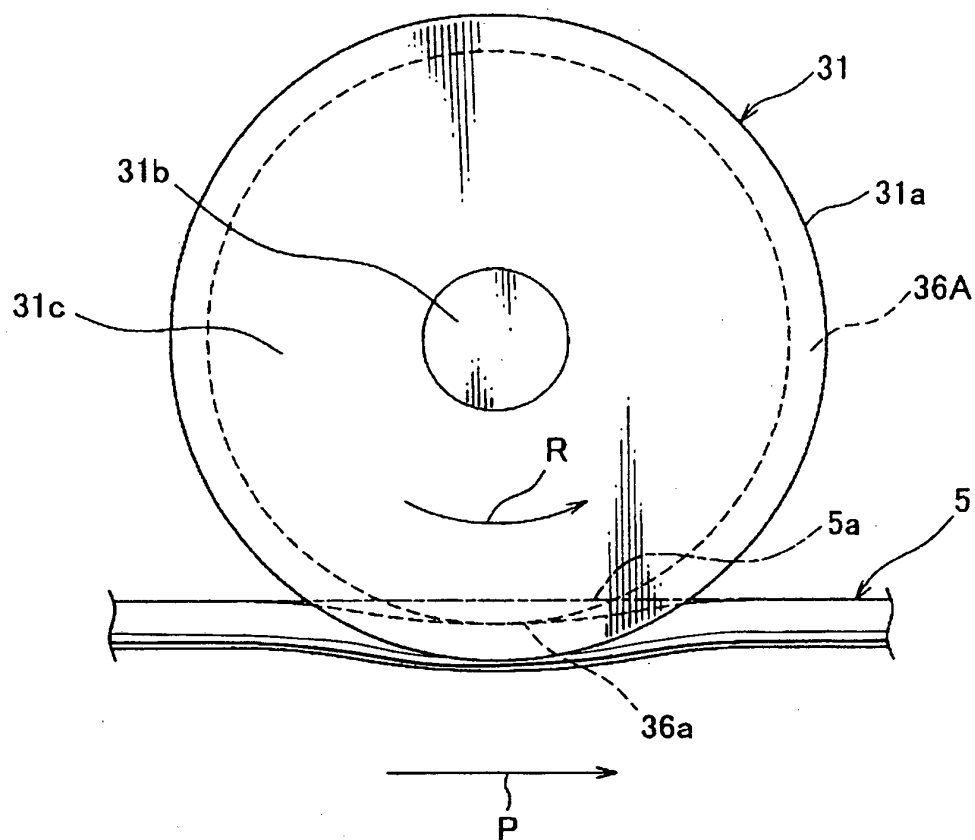


FIG. 5

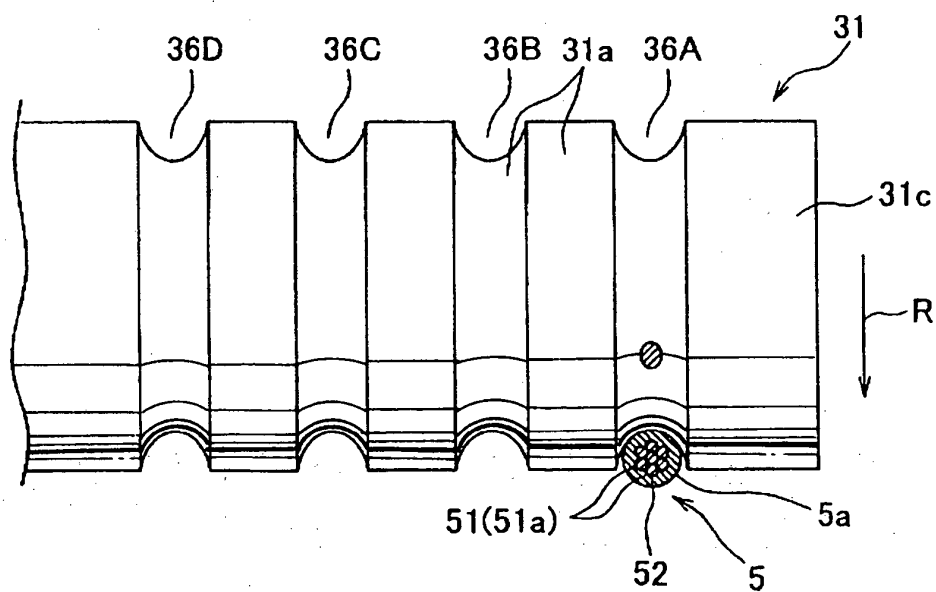


FIG. 6

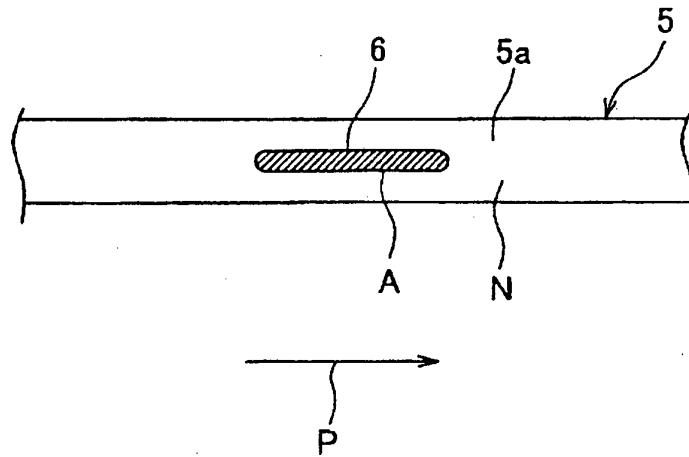


FIG. 7

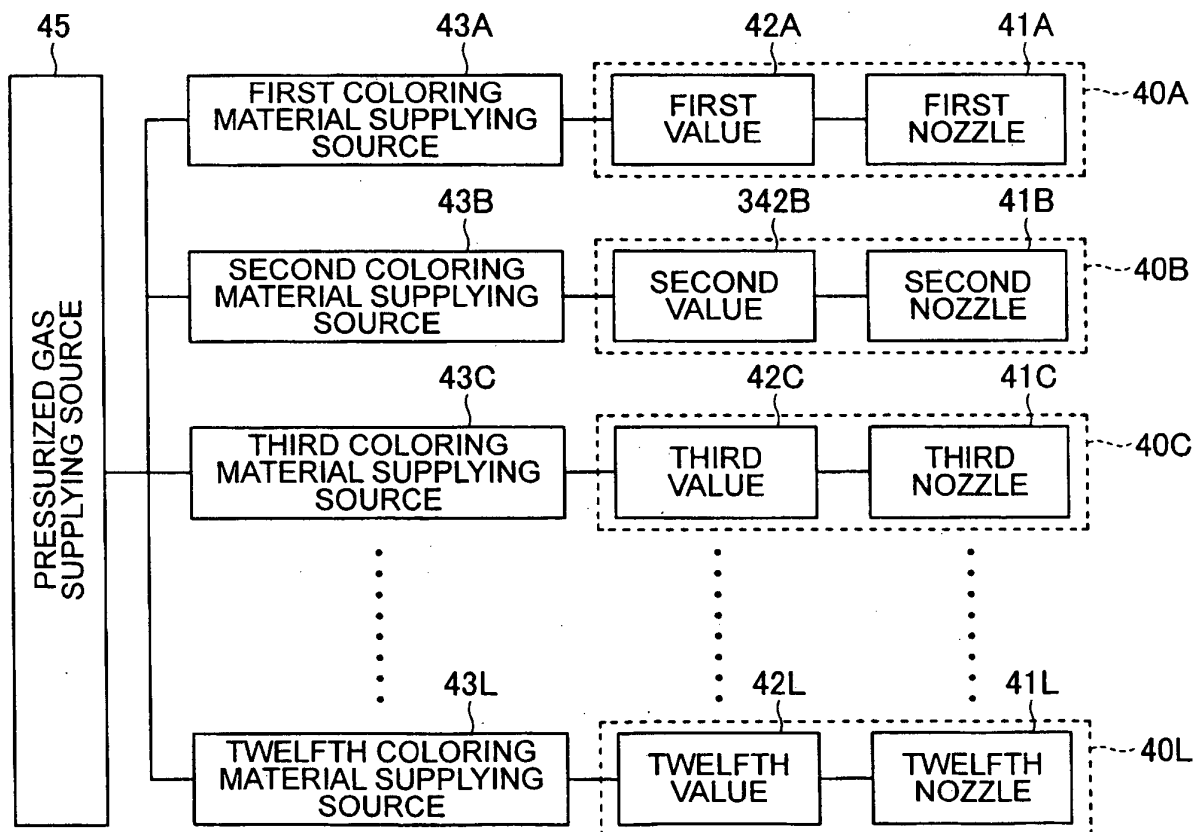


FIG. 8

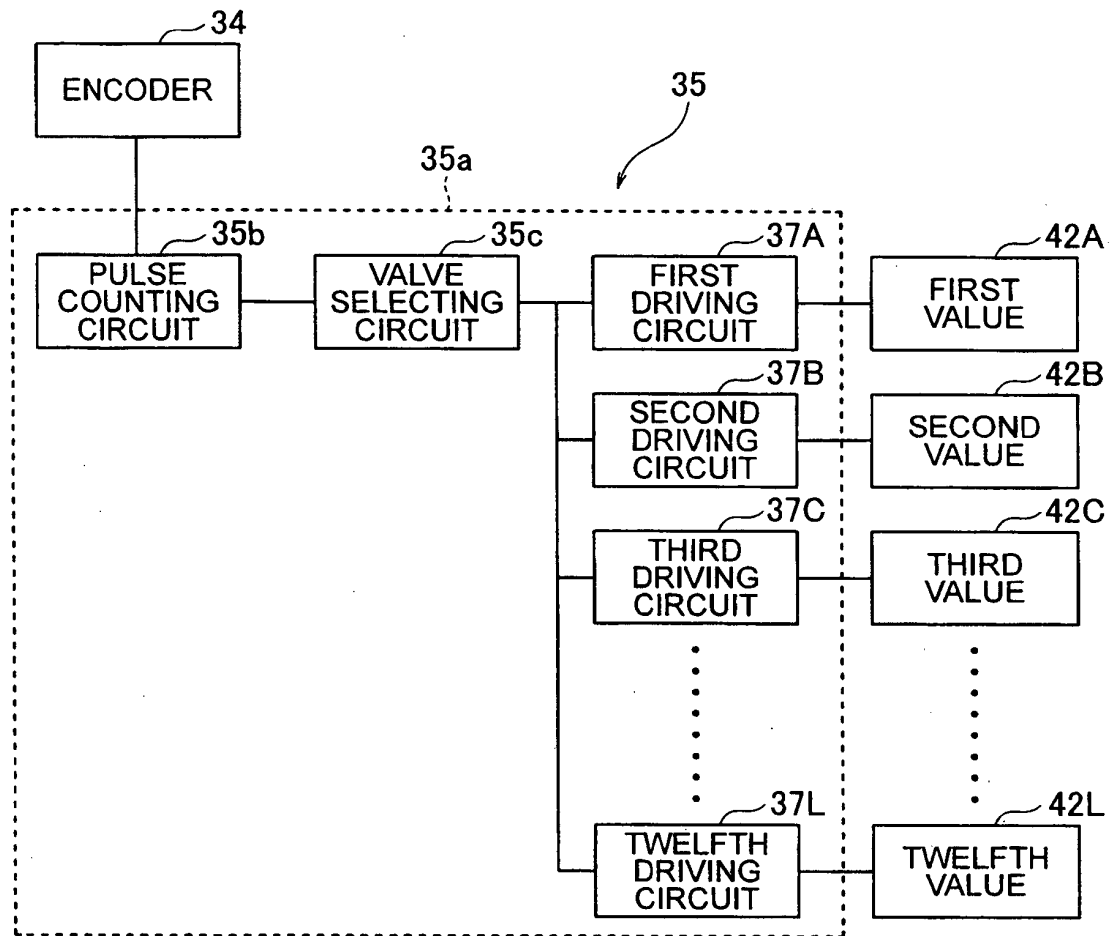
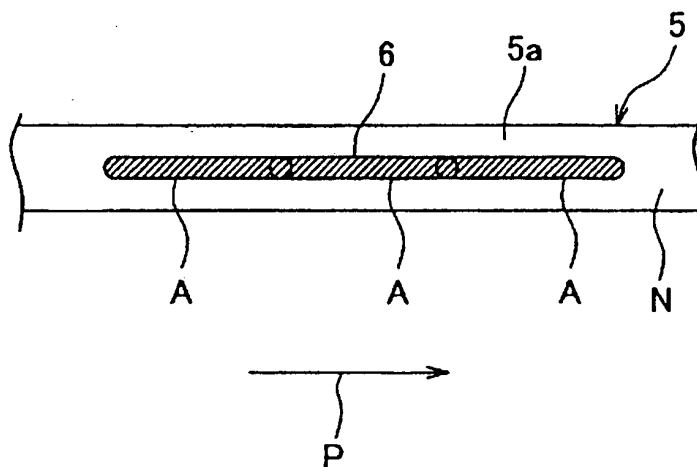


FIG. 9



REFERENCES CITED IN THE DESCRIPTION

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