



- (51) **International Patent Classification:**
G05B 9/02 (2006.01) G05B 19/418 (2006.01)
- (21) **International Application Number:**
PCT/EP2024/066782
- (22) **International Filing Date:**
17 June 2024 (17.06.2024)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
23181889.9 27 June 2023 (27.06.2023) EP
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- (81) **Designated States** (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CV, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,

HN, HR, HU, ID, IL, IN, IQ, IR, IS, IT, JM, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, MG, MK, MN, MU, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) **Designated States** (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, CV, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SC, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, ME, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:
— with international search report (Art. 21(3))
— in black and white; the international application as filed contained color or greyscale and is available for download from PATENTSCOPE

(54) **Title:** CONVEYOR ARRANGEMENT

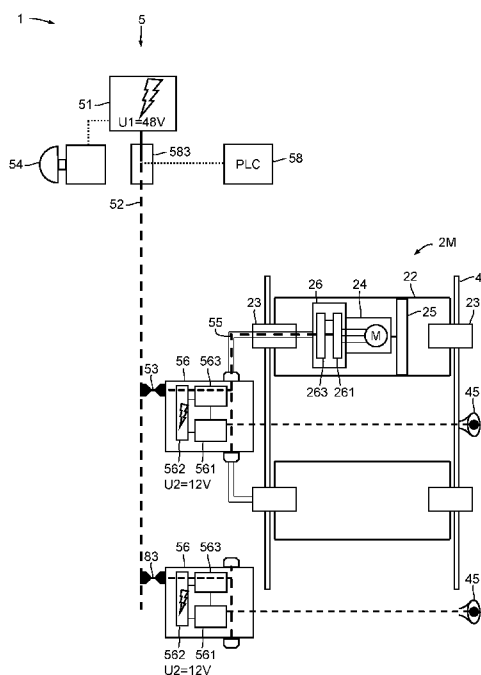


fig. 4

(57) **Abstract:** Conveyor arrangement (1), the conveyor arrangement (1) is adapted to convey an object (9), the conveyor arrangement (1) comprises a plurality of conveyor zones (1S) each having a plurality of conveyor rollers (2) comprising at least one motorized conveyor roller (2M), wherein the motorized roller (2M) has a roller tube (22) and a motor (24) located within the roller tube (22), wherein the motor (24) is adapted to set the roller tube (22) into rotation; the conveyor arrangement (1) comprises an operating power supply (51), adapted to provide an operating power at a predetermined operating voltage (U1) to power the motor (24) of the motorized rollers (2M) via a powerline (52, 55), the conveyor arrangement (1) comprises a plurality of controllers (56, 26) controlling the operation of parts of the conveyor arrangement (1); wherein the plurality of controllers (56, 26) are adapted to communicate with each other via the powerline (52, 55).



Conveyor arrangement

Background of the invention

The invention refers to a conveyor arrangement.

5 A typical conveyor arrangement is described in WO 2019/110841 A1, also published as US 2020/387142 A1. A typical conveyor arrangement comprises a plurality of motorized rollers. The conveyor arrangement is divided into several conveyor zones. Based on the determined presence of an object to be conveyed a zone controller controls operation of one of more conveyor zones. Each motorized roller has an integrated motor controller, which controls operation of the motor within the motorized roller.

10 Conventionally, the motor including the motor controller is powered by a first power supply. The zone controls are provided by a second power supply which is different to the first power supply in order to provide the zone controls with power even if the first power supply is shut down in an emergency stop mode.

15 US 2020/387142 A1 discloses a control device for a conveyor, comprising: a control unit adapted to generate control signals for a conveyor device; a data interface adapted for signal transmission of control signals to the control unit; a first energy interface adapted for an energy supply to the control unit; a connection interface adapted to establish a signal control connection and a power supply connection between the control unit and a conveyor unit located outside the control device; a second energy interface adapted for supplying energy to
20 the control unit. The first interface is adapted to receive a power supply in the form of a power supply with a first voltage and the second interface is adapted to receive a power supply in the form of a power supply with a second voltage or, instead of the second voltage, with a third voltage having a level that is different from a level of the second voltage. In the case of an emergency shutdown, the power supply can be interrupted via the power supply line, so that
25 no drive voltage is applied to the power supply line. In this case, the motor-driven conveyor rollers are immediately not supplied with drive voltage, so that they come to an immediate standstill. In this situation, the separate logic voltage line continues to supply voltage so that the control units are continuously provided with power and data loss is avoided.

30 US 2012/0046784 A1 discloses a conveyor system, comprising a number of conveyor motors and at least one control unit that is connected to each conveyor motor for sending data for regulating and/or controlling the conveyor motors. The control unit is connected to a bus line, the conveyor motor said connected to said bus line by way of a modem, preferably connected without electrical contact.

Summary of the invention

It is an object of the present invention to provide an improved conveyor arrangement having a plurality of conveyor rollers. The invention refers to an arrangement and a method according to the main claims; embodiments are subject of the subclaims and the description.

- 5 A particular idea of the present invention is to reduce the wiring architecture to a single powerline architecture, by which the amount of cables used for transmitting operating power and data are significantly reduced. This results in easier and cheaper installation.

In an embodiment during an emergency stop mode the power supply is thereby merely reduced to a reduced power voltage level, which ensures proper operation of the controls, but
 10 hinders the motor of the motorized rollers from operating. As a consequence, the control system may be fully operable, so that the motorized rollers can be brought into operation again as quickly after the power supply is available again.

Within the present invention there is made a differentiation between the terms “cable” and “conductive strands”. A cable is an arrangement having at least one or a plurality of conductive
 15 strand(s) and a tube-shaped insulation around the strand(s).

Brief description of the drawings

An example embodiment of the invention is described with respect to the figures; herein show

- fig. 1 parts of an inventive conveyor arrangement in perspective view;
- fig. 2 a conveyor zone of the conveyor arrangement according to figure 1 in perspective
 20 view;
- fig. 3 a wiring diagram of a conventional conveyor arrangement;
- fig. 4 a wiring diagram of an embodiment of an inventive conveyor arrangement;
- fig. 5 a wiring diagram of another embodiment of an inventive conveyor arrangement;
- fig. 6 an exemplary cable used within as a powerline in the inventive conveyor
 25 arrangement;
- fig. 7 schematically an emergency stop button and a power supply of the inventive conveyor arrangement in
 a) normal operation mode
 b) emergency stop mode.

Detailed description of the invention

Figure 1 shows parts of an inventive conveyor arrangement 1. The conveyor arrangement 1 comprises a plurality of rollers 2, which are arranged parallel in a manner to provide a conveying tracking along a conveying direction D. The conveyor rollers 2 are mounted on a supporting frame 4.

The rollers 2 are arranged in a manner so as to provide an inclined conveying direction D. That means that the conveying direction D is an uphill or a downhill direction in relation to the horizontal plane.

In the conveyor arrangement 1 several conveyor zones 1S are provided. Each conveyor zone 1S comprises a plurality of rollers 2, which are connected to each other via a drive connector 2C (figure 2), so that the rotational movement of all rollers of one zone are coupled to each other. The drive connector 2C may comprise one or more Poly-V-belt. The drive connector may be subject to slippage.

The zone 1S comprises a motor 2M, optionally a brake roller 2B and optionally one or more idler rollers 2L. In the present embodiment the motor is a motorized roller 2.

Reference is made to figure 3, where the electric and electronic components of a conventional conveyor arrangement 1 are shown schematically in a wiring diagram.

Each of the motorized rollers 2M comprise a roller tube 22, which are rotatably supported on at least one axle element 23 by means of a non-shown bearing. The motorized roller 2M comprises an electric motor 24 for providing a drive force for the roller tube 22. Between the motor 24 and the roller tube 22 a coupler 25 is provided which provides a torque-proof connection between a motor shaft of the motor 24 and the roller tube 22. An optional transmission (not shown) can be provided between the motor 24 and the coupler 25. Operation of the motor 24 is controlled by a motor controller 26 located within the roller tube 22.

The operation of the motor 24 is controlled by a motor controller 26, which may also comprise a frequency converter 261, in case that the motor is a synchronous motor. The motor controller 26 may be located within the roller tube 22 (as shown in figure 3) or externally. The motor controller 26 may be connected by a motor control line 76 and/or optionally by an external control line to a zone controller 74.

The conveyor arrangement 1 has in main a two-part electrical infrastructure. At first there is a power supply 8. At second there is a control network 7.

The operating power supply 8 has an operating power supply unit 81, providing operating power at a desired operating voltage U_1 (e.g. 48V) and a power range (e.g. 15kW).

5 Via an operating power cable 82 the operating power is provided to different areas of the conveyor arrangement 1, where operating power is required to drive the main operating components, such as motorized rollers 2M or other drives (not shown). By an operating power access line 83 the motor 24 of the motorized roller 2M is connected at least indirectly to the operating power cable 82. The operating power access line 83 here is merely an example of various possibilities. Within the operating power access line 83 there may be provided a voltage transformer.

10 In case of emergency, a person may press an emergency stop button 84, through which the supply of operating power is shut down immediately. All operating components are then switched off from operating power and set into a safe state.

The control network 7 has a control power supply unit 71, providing operating power at a desired control voltage U_2 (e.g. 12V) and a power range ($P = 200W$).

15 Via a control power cable 72 said control power is provided to different areas of the conveyor arrangement 1, where operating power is required to power several controls 79, 74, sensors 45 and the like. In particular a zone controller 74 is provided, having a processing unit 75, which issues control commands to the motor controller 26 via a motor control line 76. The processing unit 75 is powered by the control power supply 71. A PLC 79 may be provided,
20 which is powered by the control power supply 71. The controls are connected to each other by a control bus 73.

The processing unit 75 issues the control commands to the motor controller 26 based on a detected presence of an object to be conveyed 9, which is determined in particular by a presence sensor 45.

25 In general the presence sensor 45 may be separate to the conveyor roller; in an embodiment the presence sensor 45 may be included into the conveyor roller 2 (not shown); alternatively the presence of an object to be conveyed 9 may be determined without an explicit presence sensor 45, e.g. by evaluating currents or other conditions within the motor 24, etc.

30 Accordingly supply of power in the control network 7 is fully independent from the operating power supply 8. A main reason for this separation is to keep the controls in operation even if the operating power is shut down in particular due to the actuation of the emergency stop button 84.

The motor control line 76 may be arranged in one unitary cable 78 with the operating power access line 83.

Reference is made to figure 4, where the electric and electronic components of an inventive conveyor arrangement 1 are shown schematically in a wiring diagram.

- 5 Each of the motorized rollers 2M comprise a roller tube 22, which are rotatably supported on at least one axle element 23 by means of a non-shown bearing. The motorized roller 2M comprises an electric motor 24 for providing a drive force for the roller tube 22. Between the motor 24 and the roller tube 22 a coupler 25 is provided which provides a torque-proof connection between a motor shaft of the motor 24 and the roller tube 22. An optional
10 transmission (not shown) can be provided between the motor 24 and the coupler 25.

- Operation of the motor 24 is controlled by a motor controller 26 located within the roller tube 22. The motor controller 26 may also comprise a frequency converter 261, in case that the motor is a synchronous motor. The motor controller 26 may be located within the roller tube 22 (as shown in figure 4) or externally. The motor controller 26 is provided with power by a motor
15 powerline 55.

The conveyor arrangement 1 has a common electrical infrastructure 5, which is used for providing operating power as well as for distributing data signals.

The common electrical infrastructure 5, providing operating power at a desired operating voltage U_1 (e.g. 48V) and a power range (e.g. 15kW).

- 20 Via an operating powerline 52 the operating power is provided to different areas of the conveyor arrangement 1, where operating power is required to drive the main operating components, such as the motorized rollers 2M or other drives (not shown). By a motor powerline 55, which is connected to the operating powerline 52 by an operating power connection 53, operating power is provided to the motor 24 of the motorized roller 2M.

- 25 In case of emergency, a person may press an emergency stop button 54, through which all operating drives are switched off from sufficient operating power and set into a safe state.

The operating powerline 52 is also used to provide electric power to different areas of the conveyor arrangement 1, where power is required to power several controls 58, 56, sensors 45 and the like.

- 30 A zone controller 56 is provided, having a processing unit 561, which issues control commands to the motor controller 26. The processing unit 561 issues the control commands to

the motor controller 26 based on a detected presence of an object to be conveyed, which is determined in particular by a presence sensor 45.

The zone controller processing unit 561 issues the control commands to the motor controller 26 based on a detected presence of an object to be conveyed, which is determined in particular by a presence sensor 45.

In general the presence sensor 45 may be separate to the conveyor roller 2; in an embodiment the presence sensor 45 may be included into the conveyor roller 2 (not shown); alternatively the presence of an object to be conveyed may be detected without an explicit presence sensor, e.g. by evaluating currents or other conditions within the motor 24, etc.

10 The zone controller 56 comprising a voltage transformer 562. The voltage transformer 562 is adapted to convert the operating voltage U1 into a control voltage U2 (e.g. 12V), wherein the control voltage U2 is in particular lower than the operating voltage U1. The zone controller processing unit 561 is operated by the control voltage U2.

15 A PLC 58 may be provided, which is powered by the operating power supply 51 or by a separate power source (not shown).

Data between the PLC 58, the zone controller 56 and the motor control 26 are exchanged via the operating powerline 52 and the motor powerline 55.

Therefore the PLC 58 is connected via a PLC powerline data modem 583 to the operating powerline 52.

20 The zone controller processing unit 561 of the zone controller 56 is connected via a powerline data modem 563 of the zone controller to the operating powerline 52 and the motor powerline 55.

The frequency converter 261 of the motor controller 26 is connected via a powerline data modem 263 of the motor controller to the motor powerline 55.

25 Each of the powerline data modems 583, 563, 263 is adapted to put a data signal on the respective powerline 52, 55 and to receive a data signal from the respective powerline 52, 55.

Figure 6 shows a cross section of an exemplary cable which is used for the operating powerline 52 and the motor powerline 55. The cable has two conductive strands S, through which at the same time electric operating power and data signals are submitted.

As a consequence the supply of power for the controls is dependent from the operating power supplied via the operating power supply line.

Accordingly a solution is required for the case that the emergency stop button 54 is pressed. A solution, similar to the conventional embodiment (see figure 3), where pressing an emergency stop button 84 would simply lead to shut off the operating power completely, would also shut off the power for the controls.

Figure 7a shows the operating power supply 51 and the emergency stop button 54 during normal operation mode. The operating power supply 51 provides operating power at the desired operating power voltage U_1 . All components as shown in figure 4 are provided with sufficient power to enable proper operation.

Figure 7b shows the operating power supply 51 and the emergency stop button 54 during emergency stop mode. Here the emergency stop button 54 is pressed. An emergency stop signal 54C is provided by the emergency stop button. The term "signal" here is to be understood broad, comprising also the possibility that an "all ok" signal is being omitted.

As a reaction on the emergency stop signal 54C the operating power is reduced to a reduced power voltage U_{1E} , here e.g. 12V. As an example the reduced power voltage U_{1E} may be similar to the control voltage U_2 provided by the several voltage transformers. By providing the reduced power voltage U_{1E} the controls are still provided by sufficient power to enable operation of the controls. As an example, the emergency stop signal 54C is received by the operating power supply 51, which is adapted to reduce the provided operating voltage U_1 to the reduced power voltage U_{1E} .

In the present example the operating power supply 51 may be realized by one electric device, which is capable of providing said different voltages power voltages U_1 , U_{1E} . In another embodiment, the power supply 51 may have two separate electric device, where a first device may be adapted to provide the reduced power voltage U_{1E} and a second device may be adapted to provide the operating power voltage U_1 . Based on the status of the emergency stop button 54 either the first or the second device may be in operation to provide the respective voltage.

However the operating components such as the motorized roller 2M or any other drives etc. are not being powered in a sufficient way, so that a safety stop of the conveyor arrangement is achieved.

Figure 5 shows an inventive conveyor arrangement 1 in a second embodiment, which is based in main on the embodiment shown in figure 4. The description relating to figure 4 is also applicable to the embodiment of figure 5, where in the following the differences are described.

In the embodiment of figure 5 the separate zone controller 56 is omitted. Instead the
5 functionality of the zone controller 56 is incorporated in a control located within the roller tube 22.

Here the zone controller processing unit 561 is located within the roller tube 22. To enable the operation of the zone controller processing unit 561, the voltage transformer 562 of the zone controller 56 is also located within the roller tube 22 and provides the control voltage U2 to the
10 zone controller processing unit 561.

The powerline data modem 263 of the motor controller is connected to the zone controller processing unit 561 as well.

The zone controller processing unit 561 and the frequency converter 261 may be formed integrally.

15 The presences sensors 45 are connected to the operating powerline 52 for data transmission to the zone controller processing unit 561 of any roller 2M.

In a further alternative embodiment based on figure 4 and 5, the voltage transformer 562 may be omitted. In this embodiment the zone controller processing unit 561 is adapted to operate properly independently from the input voltage.

20 So during normal operation mode the zone controller processing unit 561 is powered by the by the operating voltage U1 of e.g. 48V. In case that the emergency stop button is pressed the zone controller zone controller processing unit 561 is powered by the reduced power voltage U1E. Same can apply for the motor controller 26.

In general for all embodiments: During the emergency stop mode the zone controller and the
25 motor controller are provided with the reduced power voltage U1E. In an embodiment the providing of reduced power voltage enables, that the motor controller 26 and/or the zone controller 56 are still in a condition to communicate via the powerline 55, 52 during the emergency stop mode with another controller. When the conveyor arrangement 1 is then switched back into the normal operation mode, the operating voltage U1 is available again.

30 Since the communication between the controllers was maintained during emergency stop mode, the motor controller can start operation of the motor without the need to reestablish the

communication beforehand. Operation can thus be started faster than in conventional systems, e.g. disclosed in PCT/EP2023/056590 (not yet published).

List of reference signs

1	conveyor arrangement
1S	conveyor zone
2	conveyor roller
2M	motor, motorized roller
2L	idler roller
2B	brake roller
2C	drive connector (Poly V belt)
4	supporting frame
45	presence sensor
5	common electric infrastructure
7	control network
8	operating power supply
9	object to be conveyed
22	roller tube
23	axle element
24	motor
25	coupler
26	motor controller
261	frequency converter
263	powerline data modem of motor controller
51	operating power supply
52	operating powerline
53	operating power connection
54	emergency stop button
55	motor powerline
56	zone controller
561	zone controller processing unit
562	voltage transformer
563	powerline data modem of zone controller
58	PLC
583	powerline data modem of PLC

U1	operating voltage
U1E	reduced power voltage
U2	control voltage
S	conductive strand
71	control power supply
72	control power cable
73	control bus
74	zone controller
75	processing unit
76	motor control line
78	unitary cable
79	PLC
81	operating power supply
82	operating power cable
83	operating power access line
84	emergency stop button
D	conveying direction

Claims

1. Conveyor arrangement (1),
the conveyor arrangement (1) is adapted to convey an object (9),
the conveyor arrangement (1) comprises a plurality of conveyor zones (1S) each having a plurality of conveyor rollers (2) comprising at least one motorized conveyor roller (2M),
wherein the motorized roller (2M) has a roller tube (22) and a motor (24) located within the roller tube (22), wherein the motor (24) is adapted to set the roller tube (22) into rotation;

the conveyor arrangement (1) comprises an operating power supply (51), adapted to provide an operating power at a predetermined operating voltage (U1) to power the motor (24) of the motorized rollers (2M) via a powerline (52, 55),

the conveyor arrangement (1) comprises a plurality of controllers (56, 26) controlling the operation of parts of the conveyor arrangement (1);

characterized in

that the plurality of controllers (56, 26) are adapted to communicate with each other via the powerline (52, 55).
2. Conveyor arrangement (1) according to the preceding claim,
wherein the plurality of controllers (56, 26) comprising zone controllers (56) adapted to control the operation of the conveyor zones (1S),
wherein the plurality of zone controllers (56) are adapted to communicate with each other via the powerline (52, 55).
3. Conveyor arrangement (1) according to the preceding claim,
wherein the plurality of controllers (56, 26) comprising motor controllers (26), each located within a roller tube (22) adapted to control the operation of the motor (24) of the respective motorized roller (2M),
wherein each of the motor controllers (26) is adapted to communicate with at least one zone controller (56) via said powerline (52, 55).

4. Conveyor arrangement (1) according to any of the preceding claims, wherein the motor (24) and the controllers (56, 26) are supplied with power at least partly via the same powerline (52, 55).
5. Conveyor arrangement (1) according to the preceding claim, wherein the conveyor arrangement (1) is adapted to be transferred from a normal operation mode into an emergency stop mode; wherein in the emergency stop mode
 - the motors (24) of the motorized rollers (2M) powered via the common operating powerline (52) are not operated due to a reduction of power, in particular power voltage (U1E), provided via the common operating powerline (52), in particular the motorized rollers are not provided with sufficient power, in particular voltage power voltage (U1E), to drive the roller tube (22);
 - at least some of the controls (56, 26) are still powered via the common operating powerline (52) with sufficient power, in particular voltage, to keep the control in operating condition.
6. Conveyor arrangement (1) according to the preceding claim, wherein in the emergency stop mode a motor controller (26), controlling operation of the motor (24) is provided with a reduced power voltage (U1E) enabling the motor controller (26) to maintain communicating via the operating powerline (52) with other controls (56).
7. Conveyor arrangement (1) according to any of claims 5 or 6, wherein upon a transfer of the conveyor arrangement (1) from the emergency stop mode into a normal operation mode, the motor controller (26) is in a condition to initiate operation of the motor (24) without the need of reestablishing a communication beforehand.
8. Method of operating a conveyor arrangement (1), in particular according to any of the preceding claims, the conveyor arrangement (1) is adapted to convey an object (9) in a normal operation mode, the conveyor arrangement (1) comprises a plurality of conveyor zones (1S) each having a plurality of conveyor rollers (2) comprising at least one motorized conveyor roller (2M), wherein the motorized roller (2M) has a roller tube (22) and a motor (24) located within the roller tube (22), wherein the motor (24) is adapted to set the roller tube

(22) into rotation during normal operation mode, wherein the operation of the motor (24) is controlled by a motor controller (26) in particular located within the roller tube (22);

the conveyor arrangement (1) comprises an operating power supply (51), adapted to provide an operating power at a predetermined operating power voltage (U1) to power the motor (24) of the motorized rollers (2M) via a powerline (52, 55),

characterized in

that during an emergency stop mode a reduced power voltage (U1E) is provided to said motor controller (26) and the motor controller (26) maintains communicating with other controllers outside via said powerline (52, 55).

9. Method according to the preceding claim, wherein upon a transfer from the emergency stop mode into a normal operation mode, the motor controller (26) is in a condition to initiate operation of the motor (24) without the need of reestablishing a communication beforehand.

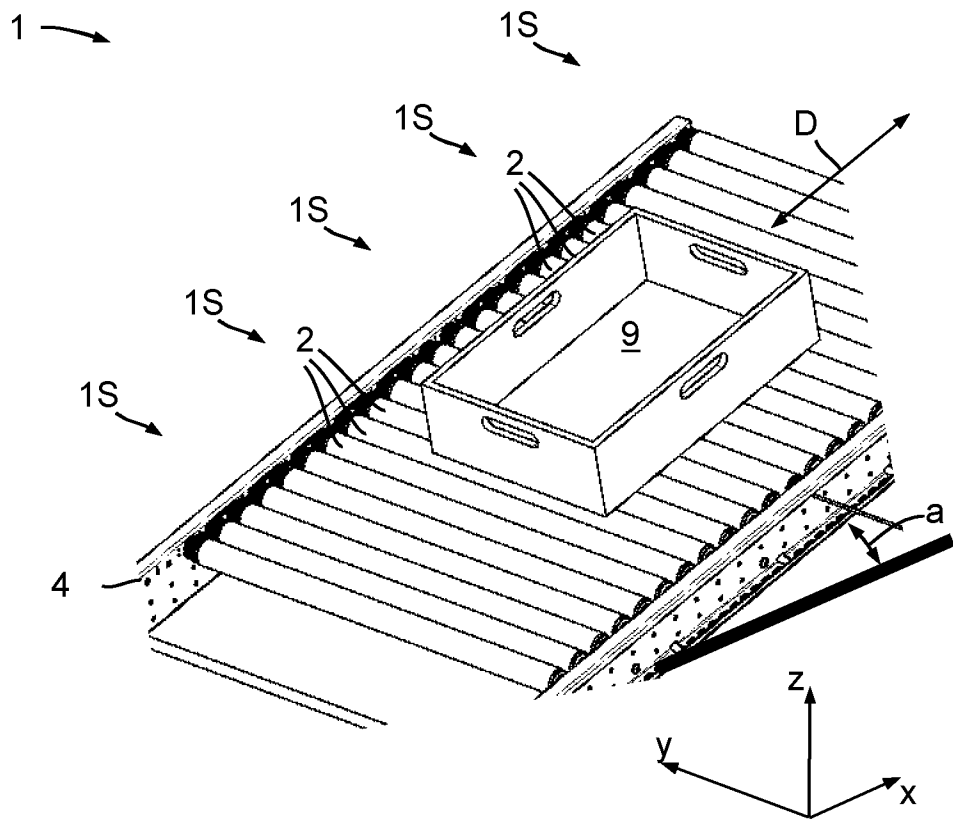


fig. 1

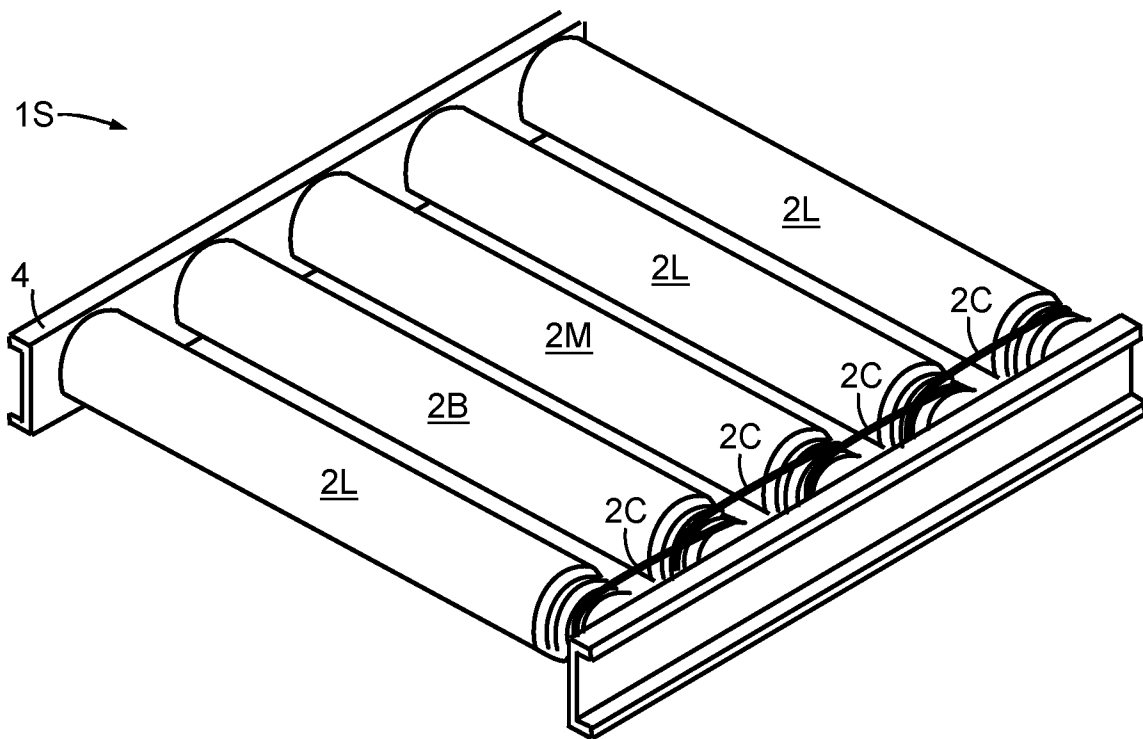


fig. 2

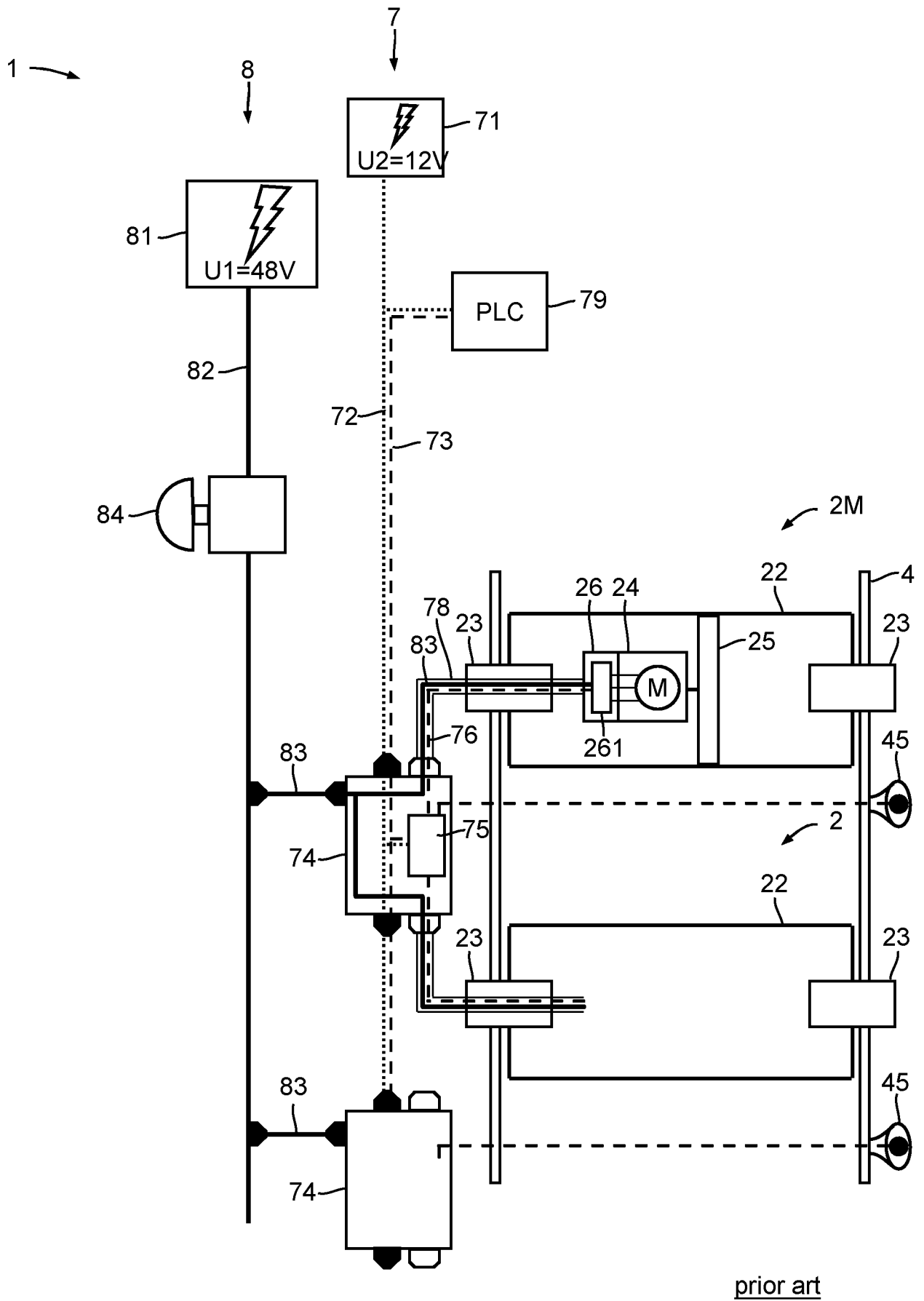


fig. 3

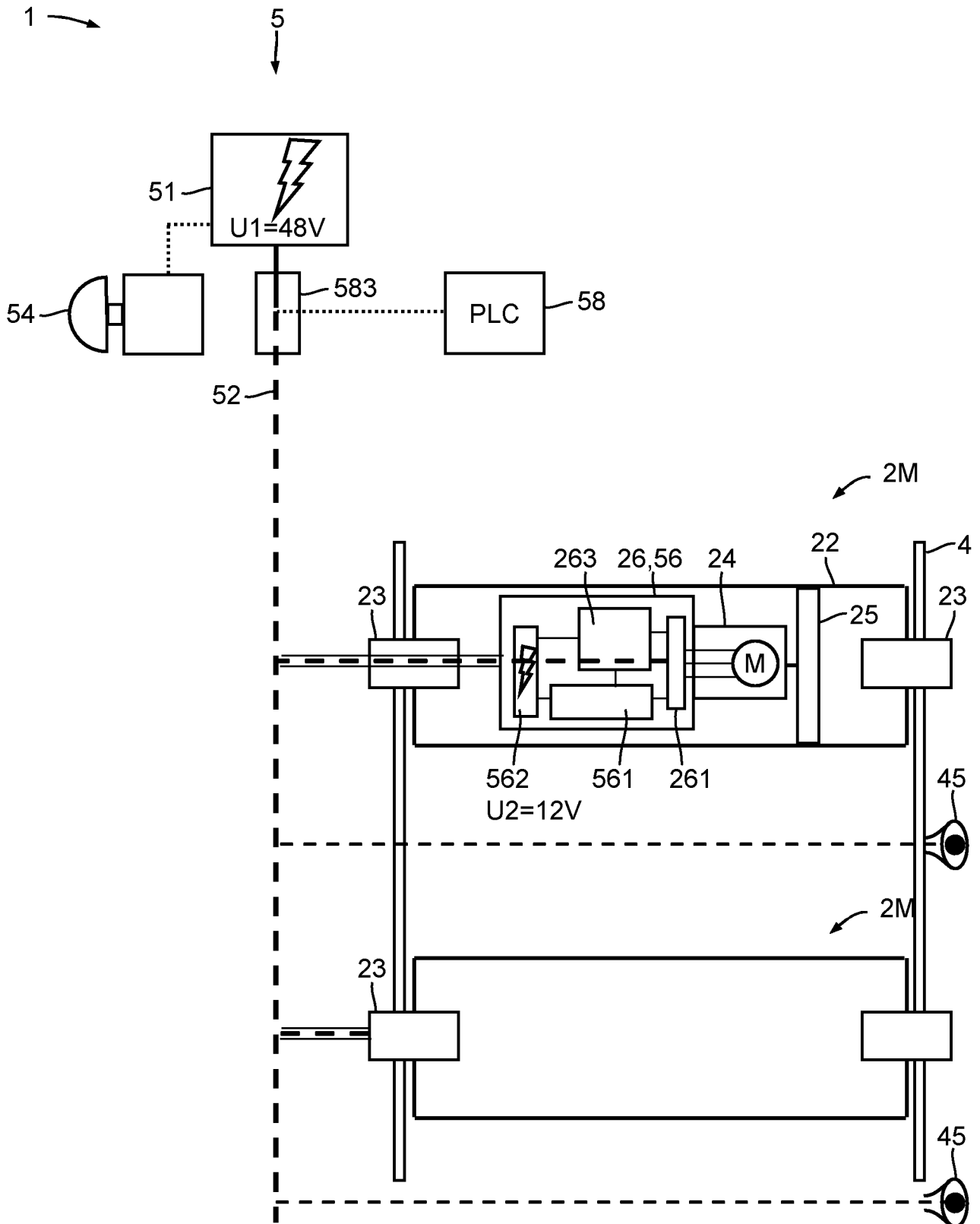


fig. 5

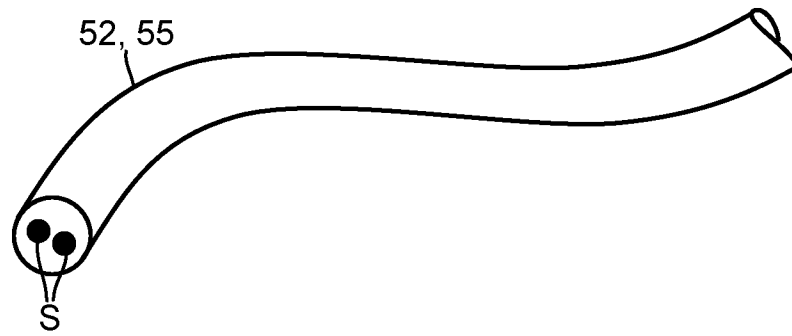


fig. 6

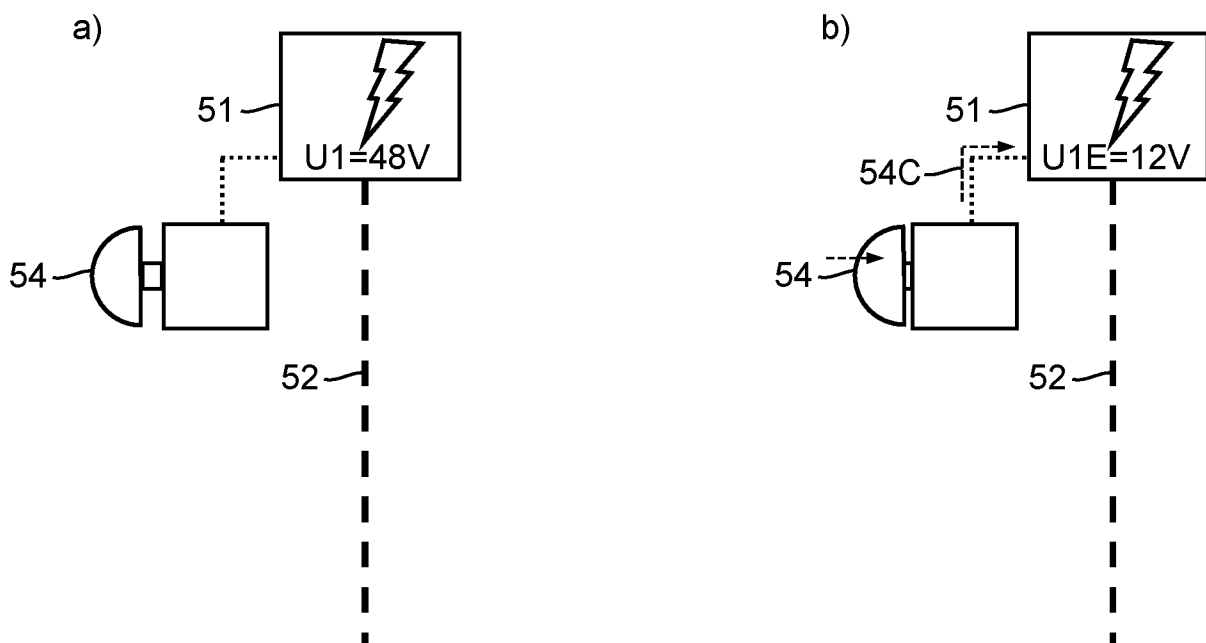


fig. 7

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2024/066782

A. CLASSIFICATION OF SUBJECT MATTER
 INV. G05B9/02 G05B19/418
 ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G05B H01H B65G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2020/387142 A1 (HENZE HERBERT [CH]) 10 December 2020 (2020-12-10) cited in the application	1-4,8
A	paragraph [0011] - paragraph [0045] -----	5-7,9
X	US 2012/046784 A1 (MALINA GEORG H [DE] ET AL) 23 February 2012 (2012-02-23) cited in the application	1-4,8
A	paragraph [0069] - paragraph [0081] -----	5-7,9
A	EP 1 003 086 A2 (SCHAKO METALLWARENFABRIK [DE]) 24 May 2000 (2000-05-24) paragraph [0014] - paragraph [0023] -----	1-9
A	US 2006/214618 A1 (HASHIMOTO YOSHIKI [JP] ET AL) 28 September 2006 (2006-09-28) paragraph [0028] - paragraph [0072] -----	1-9

Further documents are listed in the continuation of Box C.

See patent family annex.

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26 August 2024

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11/09/2024

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2024/066782

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