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(54) MACHINE CONTROL FOR GRINDING MACHINE

(57) A grinding machine including a support pedestal that supports a drive motor that supports an abrasive wheel rotatably coupled to the drive motor; a motor drive operatively coupled to the drive motor; a safety controller operatively coupled with the drive motor and motor drive; an E-stop operatively coupled to the safety controller; a foot pedal switch operatively coupled to the safety controller; and a 480 volt alternating current 3 phase electrical power supply electrically coupled to the drive motor.

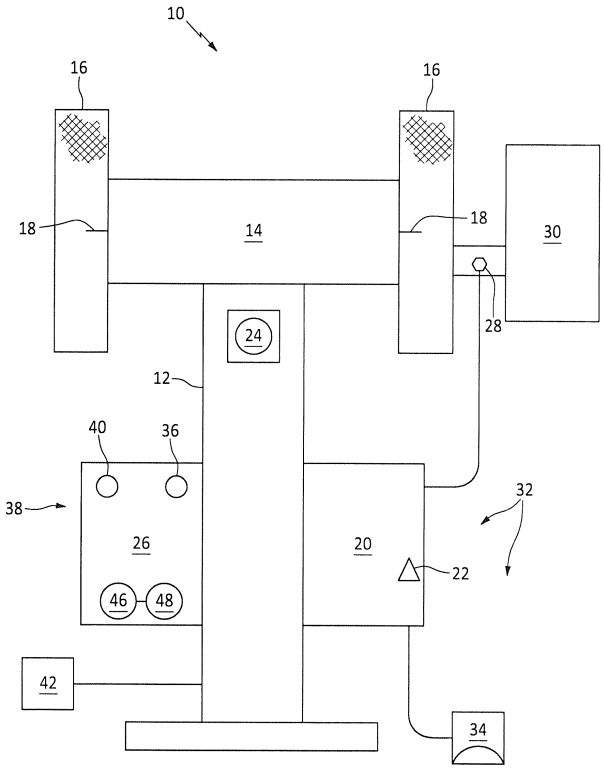

FIG. 1

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Description

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of provisional application Serial No. 63/345,629 filed May 25, 2022.

BACKGROUND

[0002] The present disclosure is directed to grinding machines and particularly to safety features for grinding machines.

[0003] A grinding machine employs a grind wheel that is formed from an abrasive material or that has an abrasive material thereon. To perform a grinding operation, the grind wheel is generally caused to rotate via a motor. Once the grind wheel is rotating at a desired rate, the grind wheel contacts a workpiece to perform a grinding operation. Typical grinding machines include a latch style on/off switch that allows for the machine to remain in operation even while being unattended by an operator. Moreover, subsequent a power outage, a grinding machine can have the switch remain in the on position, and upon reenergizing, the machine can spontaneously operate, creating a hazard. Grinding machines create substantial quantities of fine airborne particulate during operation. However, grinding machines are optionally equipped with exhaust vacuum particulate removal devices. These exhaust vacuum devices are optionally operated during the grinding operation.

SUMMARY

[0004] In accordance with the present disclosure, there is provided a grinding machine comprising a support pedestal supports a drive motor that supports an abrasive wheel rotatably coupled to the drive motor; a motor drive operatively coupled to the drive motor; a safety controller operatively coupled with the drive motor and motor drive; an E-stop operatively coupled to the safety controller; a foot pedal switch operatively coupled to the safety controller; and a 480 volt alternating current 3 phase electrical power supply electrically coupled to the drive motor.

[0005] A further embodiment of any of the foregoing embodiments may additionally and/or alternatively include the motor drive is equipped with a safe torque off feature.

[0006] A further embodiment of any of the foregoing embodiments may additionally and/or alternatively include the motor drive is programmable and configured to maintain operation of the drive motor at a predetermined speed for a material removal.

[0007] A further embodiment of any of the foregoing embodiments may additionally and/or alternatively include the safety controller is electronically coupled to the E-stop, a vacuum pressure/air flow sensor and the like.

[0008] A further embodiment of any of the foregoing embodiments may additionally and/or alternatively include the safety controller is configured to prevent operation of the drive motor responsive to predetermined conditions.

[0009] A further embodiment of any of the foregoing embodiments may additionally and/or alternatively include the grinding machine further comprising a drive motor brake operatively coupled to the drive motor.

[0010] A further embodiment of any of the foregoing embodiments may additionally and/or alternatively include the drive motor brake is configured as a dynamic brake.

[0011] In accordance with the present disclosure, there is provided a grinding machine comprising a support pedestal supports a drive motor that supports an abrasive wheel rotatably coupled to the drive motor; an exhaust vacuum coupled to the support pedestal proximate the abrasive wheel, the exhaust vacuum including a vacuum/air flow sensor; a motor drive operatively coupled to the drive motor; a safety controller operatively coupled with the drive motor and motor drive; an E-stop operatively coupled to the safety controller; a foot pedal switch operatively coupled to the safety controller; and a 480 volt alternating current 3 phase electrical power supply electrically coupled to the drive motor.

[0012] A further embodiment of any of the foregoing embodiments may additionally and/or alternatively include the motor drive is equipped with a safe torque off feature.

[0013] A further embodiment of any of the foregoing embodiments may additionally and/or alternatively include the safety controller is electronically coupled to the E-stop, the vacuum pressure/air flow sensor and the like.

[0014] A further embodiment of any of the foregoing embodiments may additionally and/or alternatively include the grinding machine further comprising a drive motor brake operatively coupled to the drive motor.

[0015] A further embodiment of any of the foregoing embodiments may additionally and/or alternatively include the safety controller is configured to detect electrical faults, short circuits, welded contacts and the like.

[0016] A further embodiment of any of the foregoing embodiments may additionally and/or alternatively include the grinding machine further comprising a fault light on a panel, wherein the safety controller is configured to provide a signal to the fault light on the panel.

[0017] In accordance with the present disclosure, there is provided a process for configuring a grinding machine for safety comprising a support pedestal supports a drive motor that supports an abrasive wheel rotatably coupled to the drive motor; coupling an exhaust vacuum to the support pedestal proximate the abrasive wheel, the exhaust vacuum including a vacuum/air flow sensor; coupling a motor drive to the drive motor; coupling a safety controller with the drive motor and motor drive; coupling an E-stop to the safety controller; coupling a foot pedal switch to the safety controller; and supplying a 480 volt alternating current 3 phase electrical power supply to the drive motor.

[0018] A further embodiment of any of the foregoing embodiments may additionally and/or alternatively include the motor drive is equipped with a safe torque off feature.

[0019] A further embodiment of any of the foregoing embodiments may additionally and/or alternatively include the motor drive is programmable and configured to maintain operation of the drive motor at a predetermined speed for a material removal.

[0020] A further embodiment of any of the foregoing embodiments may additionally and/or alternatively include the process further comprising electronically coupling the safety controller to the E-stop, a vacuum pressure/air flow sensor and the like.

[0021] A further embodiment of any of the foregoing embodiments may additionally and/or alternatively include the process further comprising configuring the safety controller to prevent operation of the drive motor responsive to predetermined conditions.

[0022] A further embodiment of any of the foregoing embodiments may additionally and/or alternatively include the process further comprising a drive motor brake operatively coupled to the drive motor.

[0023] A further embodiment of any of the foregoing embodiments may additionally and/or alternatively include the process further comprising equipping the motor drive with a safe torque off feature, wherein the safe torque off feature is configured for the drive motor to spin feely upon predetermined input.

[0024] Other details of the grinding machine are set forth in the following detailed description and the accompanying drawings wherein like reference numerals depict like elements.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025]

Fig. 1 is a schematic representation of an exemplary grinding machine.

Fig. 2 is an electrical schematic representation of the exemplary grinding machine and accessories.

DETAILED DESCRIPTION

[0026] Referring now to Fig. 1 and Fig. 2, there is illustrated at Fig. 1 an exemplary grinding machine 10. The grinding machine 10, shown as a pedestal bench grinder includes a support pedestal 12. The support pedestal 12 supports a drive motor 14 that supports an abrasive wheel 16. The abrasive wheel 16 can be driven by the drive motor 14 along a common drive shaft 18.

[0027] The drive motor 14 can be operatively coupled to a motor drive 20. The motor drive 20 is programmable and configured to maintain operation of the drive motor 14 at an optimum speed for the particular process of material removal. The motor drive 20 is equipped with a safe torque off (STO) feature 22. The safe torque off feature 22 allows for the drive motor 14 to spin feely, upon predetermined input.

[0028] An E-stop 24 is operatively coupled to a safety controller 26. The E-stop 24 can be actuated by an operator (not shown) in order to shut down the grinding machine 10. The E-stop 24 can be a dual channel device. The E-stop 24 can actuate the safe torque off feature 22.

[0029] The safety controller 26 is electronically coupled to the E-stop 24, a vacuum pressure/air flow sensor 28 and the like. The safety controller 26 prevents operation of the motor 14 responsive to predetermined conditions. For example, if the safety controller 26 receives a signal from the vacuum/air flow sensor 28 that the exhaust ventilation unit 30 is not in operation, then the safety controller 26 will not allow actuation of the drive motor 14. The safety controller 26 can be configured to test any safety devices 32 of the grinding machine, such as the E-stop 24, the vacuum pressure/air flow sensor 28, foot pedal switch 34 and the like.

[0030] The foot pedal switch 34 is operatively coupled to the safety controller 26. An operator provides foot pressure on the foot pedal switch 34 to provide a signal to the safety controller 26 for drive motor 18 operation.

[0031] The safety controller 26 can detect electrical faults, such as short circuits, welded contacts and the like. The safety controller 26 can provide a signal to a fault light 36 on a panel 38. An E-stop reset 40 is electrically coupled to the safety controller 26. The E-stop reset 40 is needed to bring the grinding machine 10 back into operation.

[0032] A 480 volt AC 3 phase electrical power supply 42 is electrically coupled to the drive motor 14. The 3 phase configuration allows for the drive motor 14 brake to be a dynamic brake 44. As the phasing is reversed, responsive to a safety controller 26 condition precedent, the drive motor 14 turns in an opposite direction. In an exemplary embodiment, the foot pedal switch 34, upon depression, activates the drive motor 14. Release of the foot pedal switch 34 initiates the dynamic brake 44, in 2 seconds. The foot pedal switch 34 also prevents operation of the grinding machine 10 when unattended.

[0033] Redundant safety relays 46, 48 can be electrically coupled with the safety controller 26 and power supply 42.

[0034] A technical advantage of the grinding machine disclosed includes redundant safety features that prevent operator injury.

[0035] Another technical advantage of the grinding machine disclosed includes programmable motor controller for speed optimization.

[0036] Another technical advantage of the grinding machine disclosed includes advanced safety features that prevent the drive motor from spinning after shut down.

[0037] Another technical advantage of the grinding machine disclosed includes multiple sensors that ensure safety devices are active before operation of the grinding machine.

[0038] There has been provided a grinding machine. While the grinding machine has been described in the context of specific embodiments thereof, other unforeseen alternatives, modifications, and variations may become apparent to those skilled in the art having read the foregoing description. Accordingly, it is intended to embrace those alternatives, modifications, and variations which fall within the broad scope of the appended claims.

Claims

1. A grinding machine (10) comprising:

a support pedestal (12) supports a drive motor (14) that supports an abrasive wheel (16) rotatably coupled to the drive motor (14);
a motor drive (20) operatively coupled to the drive motor (14);
a safety controller (26) operatively coupled with the drive motor (14) and motor drive (20);
an E-stop (24) operatively coupled to the safety controller (26);
a foot pedal switch (34) operatively coupled to the safety controller (26); and
a 480 volt alternating current 3 phase electrical power supply (42) electrically coupled to the drive motor (14) .

2. The grinding machine (10) according to claim 1, wherein said motor drive (20) is equipped with a safe torque off feature (22).

3. The grinding machine (10) according to claim 1 or 2, wherein said motor drive (20) is programmable and configured to maintain operation of the drive motor (14) at a predetermined speed for a material removal.

4. The grinding machine (10) according to any one of claims 1 to 3, wherein the safety controller (26) is electronically coupled to the E-stop (24), a vacuum pressure/air flow sensor (28) and the like.

5. The grinding machine (10) according to any one of claims 1 to 4, wherein the safety controller (26) is configured to prevent operation of the drive motor (14) responsive to predetermined conditions.

6. The grinding machine (10) according to any one of claims 1 to 5, further comprising:
a drive motor brake operatively coupled to the drive motor (14).

7. The grinding machine (10) according to claim 6, wherein said drive motor brake is configured as a dynamic brake (44) .

8. The grinding machine (10) according to any one of claims 1 to 7, further comprising:
an exhaust vacuum (30) coupled to the support pedestal proximate the abrasive wheel (16), the exhaust vacuum including a vacuum/air flow sensor (28).

9. The grinding machine according (10) to any one of claims 1 to 8, wherein the safety controller (26) is configured to detect electrical faults, short circuits, welded contacts and the like; and/or
further comprising:
a fault light on a panel, wherein the safety controller (26) is configured to provide a signal to the fault light on the panel.

10. A process for configuring a grinding machine (10) for safety comprising:

a support pedestal (12) supports a drive motor (14) that supports an abrasive wheel (16) rotatably coupled to the drive motor (14);
coupling an exhaust vacuum to the support pedestal (12) proximate the abrasive wheel (16), the exhaust vacuum including a vacuum/air flow sensor (28);
coupling a motor drive (20) to the drive motor (14);
coupling a safety controller (26) with the drive motor (14) and motor drive (20);
coupling an E-stop (24) to the safety controller (26);
coupling a foot pedal switch (34) to the safety controller (26); and
supplying a 480 volt alternating current 3 phase electrical power supply (42) to the drive motor (14).

11. The process of claim 10, wherein said motor drive (20) is equipped with a safe torque off feature (22).

12. The process of claim 10 or 11, wherein said motor drive (20) is programmable and configured to maintain operation of the drive motor (14) at a predetermined speed for a material removal.

13. The process of any one of claims 10 to 12, further comprising:
electronically coupling the safety controller (26) to the E-stop (24), a vacuum pressure/air flow sensor (28) and the like.

14. The process of any one of claims 10 to 13, further comprising:
configuring the safety controller (26) to prevent operation of the drive motor (14) responsive to predetermined conditions.

15. The process of any one of claims 10 to 14, further

comprising:

a drive motor brake operatively coupled to the drive motor (14); and/or
equipping the motor drive (20) with a safe torque off feature (22), wherein the safe torque off feature (22) is configured for the drive motor (14) to spin feely upon predetermined input.

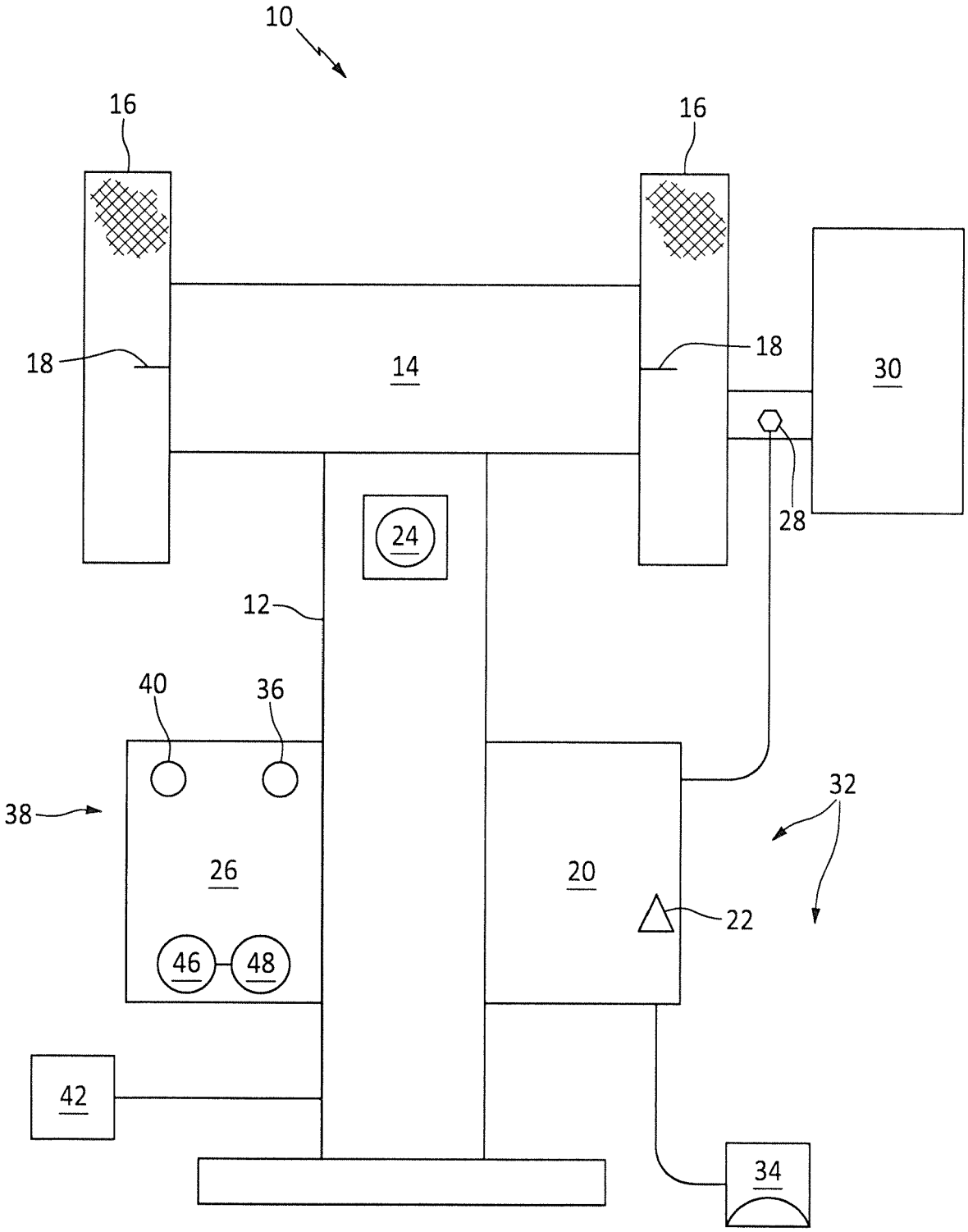

FIG. 1

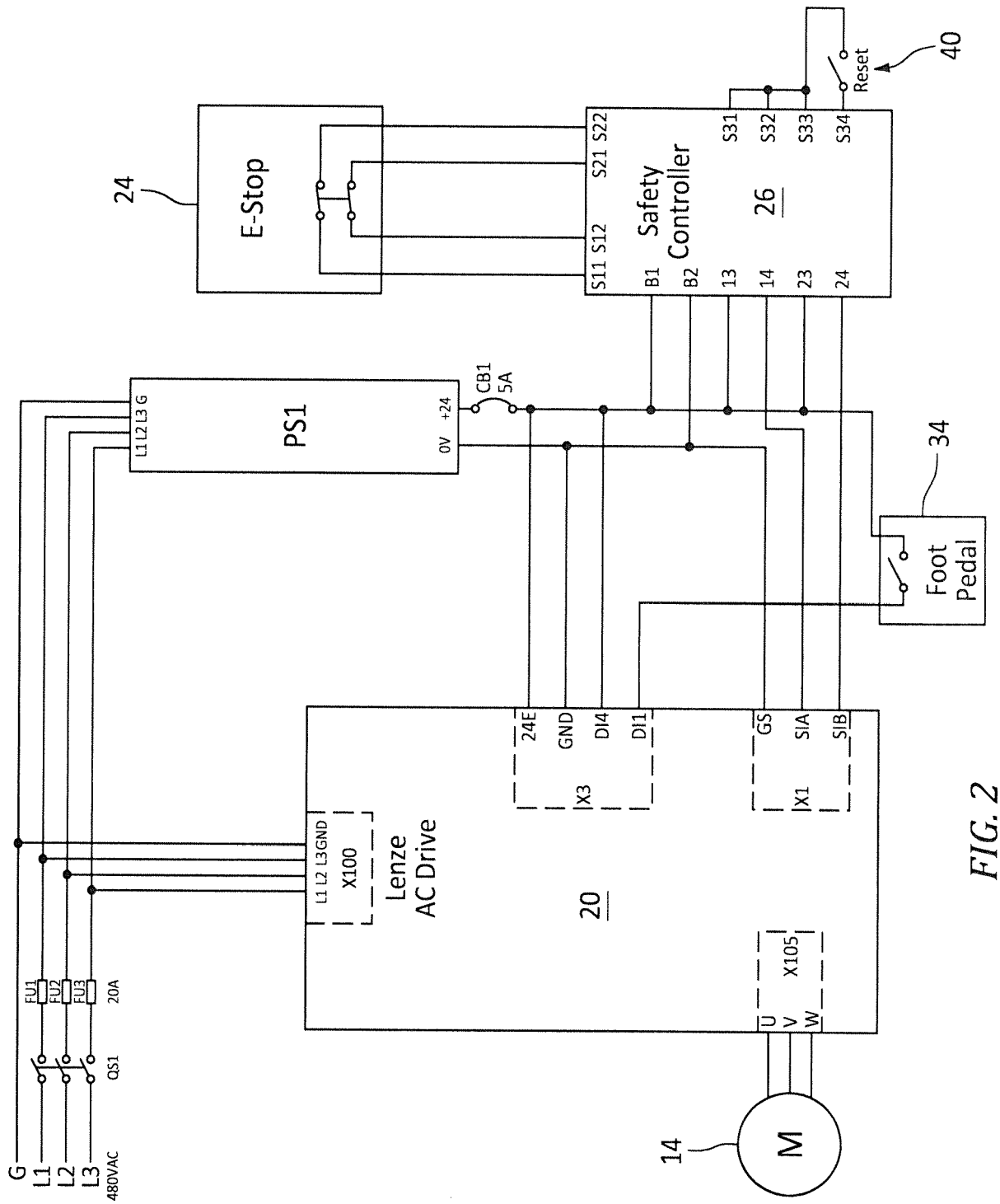
24
E-Stop
S11 S12
S21 S22
Safety Controller
26
B1
B2
13
14
23
24
S31
S32
S33
S34
Reset
40
PS1
L1 L2 L3 G
0V
+24
CB1
5A
34
Foot Pedal
24E
GND
DI4
DI1
X3
GS
SIA
SIB
X1
Lenze AC Drive
20
L1 L2 L3 GND
X100
U
V
W
X105
14
M
FU1
FU2
FU3
20A
QS1
G
L1
L2
L3
480VAC

FIG. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 23 17 4978

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TECHNICAL FIELDS SEARCHED (IPC)

B24B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	6 October 2023	Bermejo, Marco

CATEGORY OF CITED DOCUMENTS

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