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(54) **METHOD FOR REPORTING CRITICAL EVENTS ON TEXTILE MACHINES FED BY A PLURALITY OF YARNS OF YARNS**

(57) A textile machine (M) fed by a plurality of yarns, each subjected to a sensing device (AF1, AF2, AF3; PF1, PF2, PF3; S1, S2, S3) that is adapted to generate a stop signal upon the occurrence of a critical event, and controlled by a monitoring device (MD) which is connected in order to exchange data with the sensing devices and in order to stop the textile machine (M) upon reception

of the stop signal from at least one of them; the monitoring device (MD) is provided with wireless connectivity in order to communicate with at least one mobile terminal (MT1, MT2, MT3), and following the reception of the stop signal, it sends an alarm signal to the mobile terminal (MT1, MT2, MT3), which generates as a consequence an alert for the user.

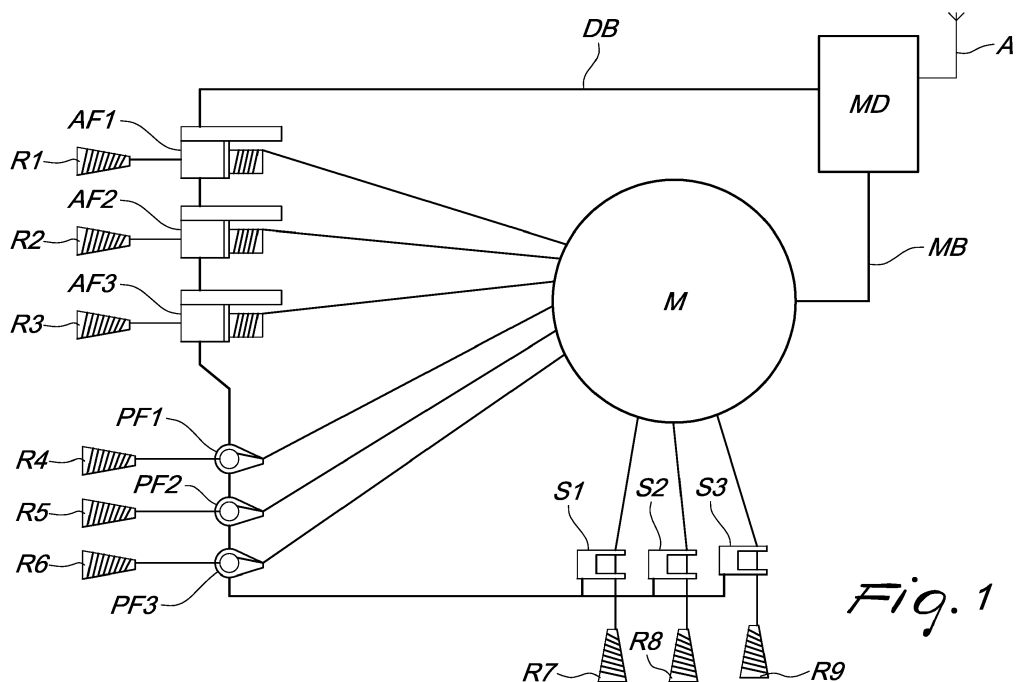


Fig. 1

Description

[0001] The present invention relates to a method for reporting critical events on textile machines which are fed by a plurality of yarns.

[0002] As is known, a generic textile machine, such as a circular knitting machine, can be fed by a plurality of yarns that are unreeled from respective spools and which define what are known as "drops".

[0003] Every drop can have a sensing device which is adapted to detect critical events such as the breakage of the yarn, the presence of a knot, and the like. Such device can be a self-contained sensor, or it can be a sensor incorporated in a weft feeder, e.g., a storage weft feeder or a rotating-distaff weft feeder, the principal purpose of which is to stabilize the tension with which the yarn is fed to the machine at a desired level.

[0004] The sensors and the feeds are all connected to a monitoring device which, upon the occurrence of a critical event on one of the drops, stops the machine.

[0005] The monitoring device can also be provided with wireless connectivity for remotely controlling the operating parameters of the machine and of the feeds associated therewith.

[0006] A drawback of the textile systems known today is that, in the event of a critical event on one of the feeders, some time can elapse before a textile factory operator notices the problem and intervenes to resolve it. This is because, often, the supervision of a large number of machines is assigned to a single operator who, usually, also has other duties in the factory and therefore cannot supervise all the machines full time, also considering the sporadic nature with which such critical events occur.

[0007] Furthermore, even after noticing the problem, the operator can take some considerable time to identify the device (sensor or feeder) on which it is necessary to intervene.

[0008] Such drawback is particularly felt with large-diameter circular knitting machines, which can be served by more than three hundred devices arranged around the machine at relatively great heights, so as to be difficult to access in order to verify their operation.

[0009] Furthermore, the lack of advance knowledge of the nature of the problem generates further delays in the resolution thereof and, as a consequence, a lengthening of the machine shutdown times.

[0010] For example, the seizing of the motor of a rotating-distaff weft feeder is typically due to the jamming of the yarn on the spool upstream of the feeder. Therefore, in order to resolve the problem, the operator has to go to the area of the spools in order to manually free the yarn. On the contrary, in the event of breakage of the yarn output by the feeder, the operator has to manually re-thread the yarn in the area between the feeder and the machine.

[0011] The aim of the present invention is therefore to devise a method for reporting critical events on textile machines fed by a plurality of yarns, which, upon the

occurrence of a critical event on a drop, enables the operator to be aware, practically in real time, of the exact location of the device(s) affected by the problem as well as the nature of such problem, so as to minimize the intervention times and, therefore, the machine shutdown times.

[0012] A further object of the invention is to devise a method that can be implemented using data transmission infrastructures that are already in use, so as to limit the costs.

[0013] The above aim and other advantages, which will become more apparent from the description that follows, are achieved by the method having the characteristics recited in claim 1, while the dependent claims define other characteristics of the invention which are advantageous, although secondary.

[0014] Now the invention will be described in more detail, with reference to some preferred, but not exclusive, embodiments thereof, which are illustrated for the purposes of non-limiting example in the accompanying drawings, wherein:

Figure 1 schematically illustrates a textile machine fed by a plurality of yarns, on which the method according to the invention can be applied;

Figure 2 schematically illustrates a wireless communication system to which a plurality of machines of the type shown in Fig. 1 are connected;

Figure 3 is a flowchart describing the method according to the invention.

[0015] With reference to Fig. 1, a textile apparatus comprises a textile machine M, e.g., a circular knitting machine, which receives a plurality of yarns from respective spools such as R1-R9. Each feed line defines a yarn "drop".

[0016] Along each one of the drops there is a sensing device which is adapted to detect critical events such as the breakage of the yarn, the presence of a knot, and the like.

[0017] In some cases such sensing device is incorporated in a storage weft feeder such as AF1, AF2, AF3, in other cases it is incorporated in a rotating-distaff weft feeder such as PF1, PF2, PF3, in still other cases it comprises a dedicated self-contained sensor such as S1, S2, S3.

[0018] The machine M is controlled by a monitoring device MD through a first bus MB, and is connected in order to transmit/receive data to/from the sensing devices through a second bus DB which interconnects all the devices.

[0019] Upon the occurrence of a critical event on one of the drops, the affected sensing device transmits a stop signal to the monitoring device MD using the second bus DB. Upon reception of the stop signal, the monitoring device MD sends a command to stop the machine M using the first bus MB.

[0020] With reference to Fig. 2, the monitoring device

MD is further provided with wireless connectivity, e.g., wireless LAN technology according to the conventional IEEE 802.11 standard, in order to communicate using an antenna A with a plurality of mobile terminals such as MT1, MT2, MT3, through an access point AP that generates a wireless LAN infrastructure to which all the mobile terminals connect.

[0021] The mobile terminal can be a smartphone, a tablet computer, or any other conventional or dedicated device, as long as it is provided with a wireless transceiver, in this embodiment, wireless LAN technology.

[0022] The system shown in the example in Fig. 2 includes seven machines M1-M7, each one of which is associated with a respective monitoring device MD1-MD7.

[0023] With reference to the flowchart in Fig. 3, where the block 100 indicates the start of the method according to an embodiment of the invention, after one of the monitoring devices MD1-MD7 has received a stop signal (block 110), it queries each one of the sensing devices to which it is connected through the second bus MD on the alarm status (active/inactive) and, if the alarm is active, on the cause of the problem, i.e., the nature of the critical event (block 120).

[0024] In a preferred embodiment of the method according to the invention, the querying by the monitoring device begins only when the latter has received confirmation that the machine is stopped. As an alternative, the querying could begin directly upon reception of the stop signal originating from the sensing devices.

[0025] Preferably, each one of the mobile terminals MT1-MD3 carries, stored, all the IP addresses of the monitoring devices associated with the machines assigned to its user (e.g., the user of the mobile terminal MT1 has the machines M1, M2, M3 assigned; the user of the mobile terminal MT2 has the machines M4, M5 assigned; the user of the mobile terminal MT3 has the machines M6, M7 assigned), and is programmed to cyclically query them on the active/inactive stop status of the machine.

[0026] In response to the querying by the mobile terminal (block 130), the monitoring device sends an alarm signal that, advantageously, includes operating information that comprises an identification code of the machine with which it is associated and information on the active/inactive stop status; if the stop is active, the monitoring device preferably also transmits the list of the device(s) with the alarm status active and the cause of the problem(s) (block 140).

[0027] Upon reception of the aforementioned operating information, the mobile terminal generates an alert, e.g., an acoustic alert or a vibration, so as to alert the user, and displays the information e.g., on an integrated screen for devices such as smartphones, tablet computers, and the like.

[0028] In this manner, not only is the user made aware, practically in real time, of the occurrence of a critical event on one of the machines, but also of the machine, of the

device(s) that generated the alarm, and also the cause of the problem.

[0029] Therefore, according to the set objects, the method explained above makes it possible to considerably reduce the intervention times in the event of a critical event such as the breakage of the yarn or the jamming of a feeder, and therefore the machine shutdown times.

[0030] Furthermore, the method can be carried out using wireless infrastructures already in use, so as to reduce the implementation costs.

[0031] Programming the system in order to carry out the method according to the invention comes under the normal knowledge of the person skilled in the art and therefore it will not be discussed further here.

[0032] In an alternative embodiment of the invention, the sensing device, together with the stop signal, immediately also supplies the operating information to the monitoring device. Therefore, the step of querying the sensing devices by the monitoring device is no longer necessary.

[0033] In a further alternative embodiment of the method according to the invention, the mobile terminals, instead of cyclically interrogating the monitoring device, wait passively for an alert from the latter, which is programmed to send the operating information on its own initiative upon the occurrence of a critical event.

[0034] Some preferred embodiments of the invention have been described, but obviously the person skilled in the art may make various modifications and variations within the scope of protection of the appended claims.

[0035] For example, for machines served by a low number of drops, the operating information sent to the mobile terminal could include only the position of the drop affected by the problem. In fact, if there are few machines to supervise, the alarm signal alone may be sufficient.

[0036] The disclosures in Italian Patent Application No. 102015000016061 (UB2015A000777) from which this application claims priority are incorporated herein by reference.

[0037] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A method for reporting critical events on a textile machine (M) fed by a plurality of yarns, each subjected to a sensing device (AF1, AF2, AF3; PF1, PF2, PF3; S1, S2, S3) that is adapted to generate a stop signal upon the occurrence of a critical event, said textile machine (M) being controlled by a monitoring device (MD) which is connected in order to exchange data with each one of said sensing devices and in order

- to stop the textile machine (M) upon reception of said stop signal from at least one of them, said monitoring device (MD) being further provided with wireless connectivity in order to communicate with at least one mobile terminal (MT1, MT2, MT3), **characterized in that** said monitoring device (MD), following the reception of said stop signal, sends an alarm signal to the mobile terminal (MT1, MT2, MT3), said mobile terminal (MT1, MT2, MT3) being programmed to generate as a consequence an alert for the user.
2. The method according to claim 1, **characterized in that** said alarm signal contains operating information related to the sensing devices that detected the critical event, said mobile terminal (MT1, MT2, MT3) being programmed to display said operating information.
 3. The method according to claim 2, **characterized in that** said monitoring device (MD), upon reception of said stop signal, requests said operating information from each one of said sensing devices (AF1, AF2, AF3; PF1, PF2, PF3; S1, S2, S3).
 4. The method according to claim 2, **characterized in that** said sensing device, together with said stop signal, also supplies said operating information to said monitoring device.
 5. The method according to one or more of claims 1-4, **characterized in that** said monitoring device (MD) sends said alarm signal to the mobile terminal (MT1, MT2, MT3) upon the request thereof, said mobile terminal (MT1, MT2, MT3) being programmed to cyclically query said monitoring device (MD).
 6. The method according to one or more of claims 1-4, **characterized in that** said monitoring device (MD) is programmed to send said alarm signal on its own initiative upon the occurrence of a critical event.
 7. The method according to one or more of claims 1-6, **characterized in that** said operating information related to the sensing devices that reported a critical event includes the location of the yarn affected by the critical event.
 8. The method according to one or more of claims 1-7, **characterized in that** said operating information related to the sensing devices that reported a critical event includes the nature of the critical event.
 9. The method according to one or more of claims 1-8, **characterized in that** said mobile terminal (MT1, MT2, MT3) carries, stored, a plurality of addresses of monitoring devices (MD1-MD7) which are associated with respective machines (M1-M7) that are assigned for surveillance to a user of said mobile terminal, and **in that**, upon the occurrence of a critical event on one of the machines, with consequent sending of said alarm signal and of said operating information by the respective monitoring device, the latter sends an identification code of the machine with which it is associated.
 10. The method according to claim 9, **characterized in that** each one of said monitoring devices (MD1-MD7) communicates with the mobile terminal to which the respective machine is assigned by means of an access point (AP) using wireless LAN technology.
 11. The method according to one or more of claims 3-10, **characterized in that** the request for operating information by the monitoring device begins after the latter has received a confirmation that the textile machine is stopped.
 12. The method according to one or more of claims 3-10, **characterized in that** the request for operating information by the monitoring device begins directly upon reception of the stop signal.

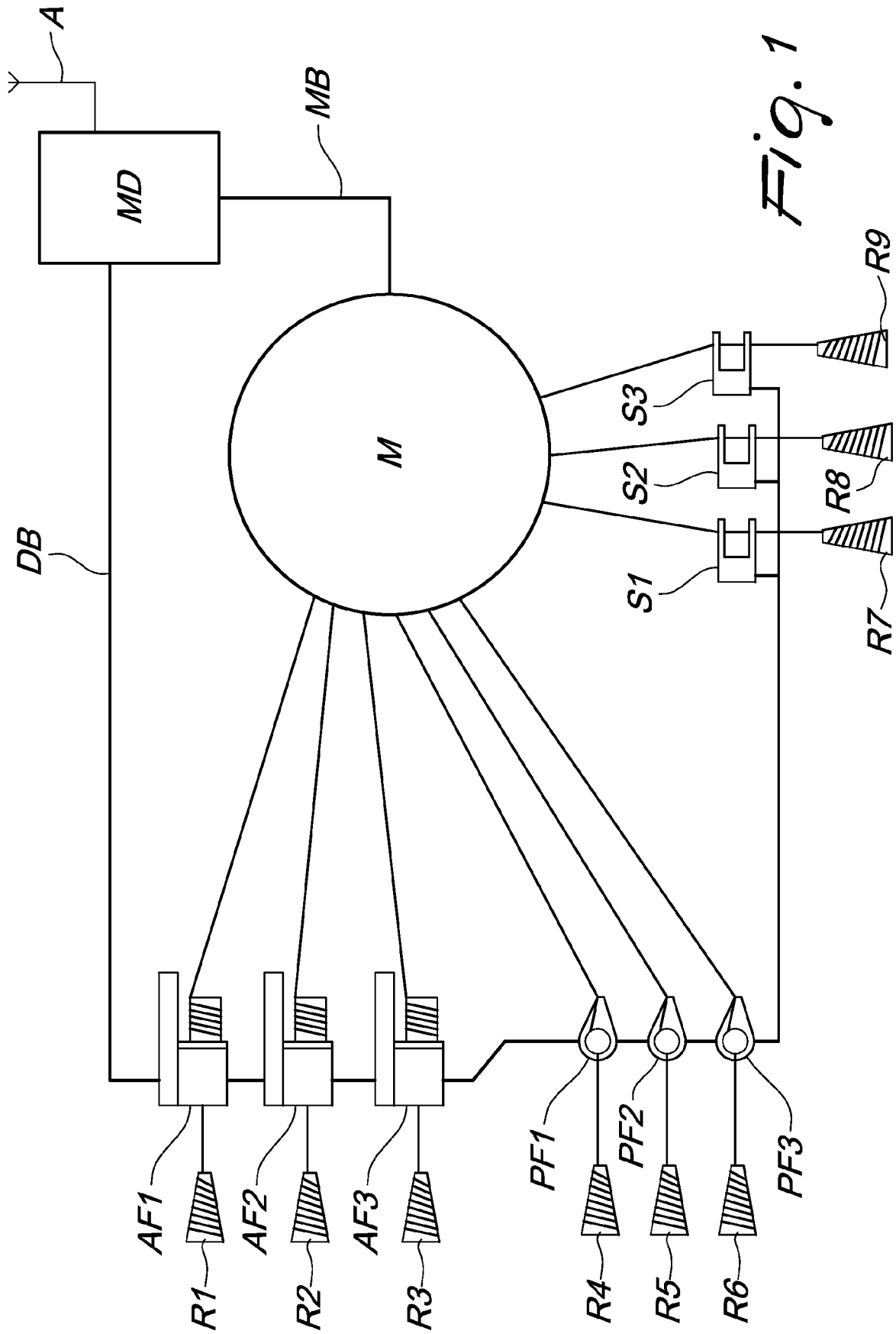


Fig. 1

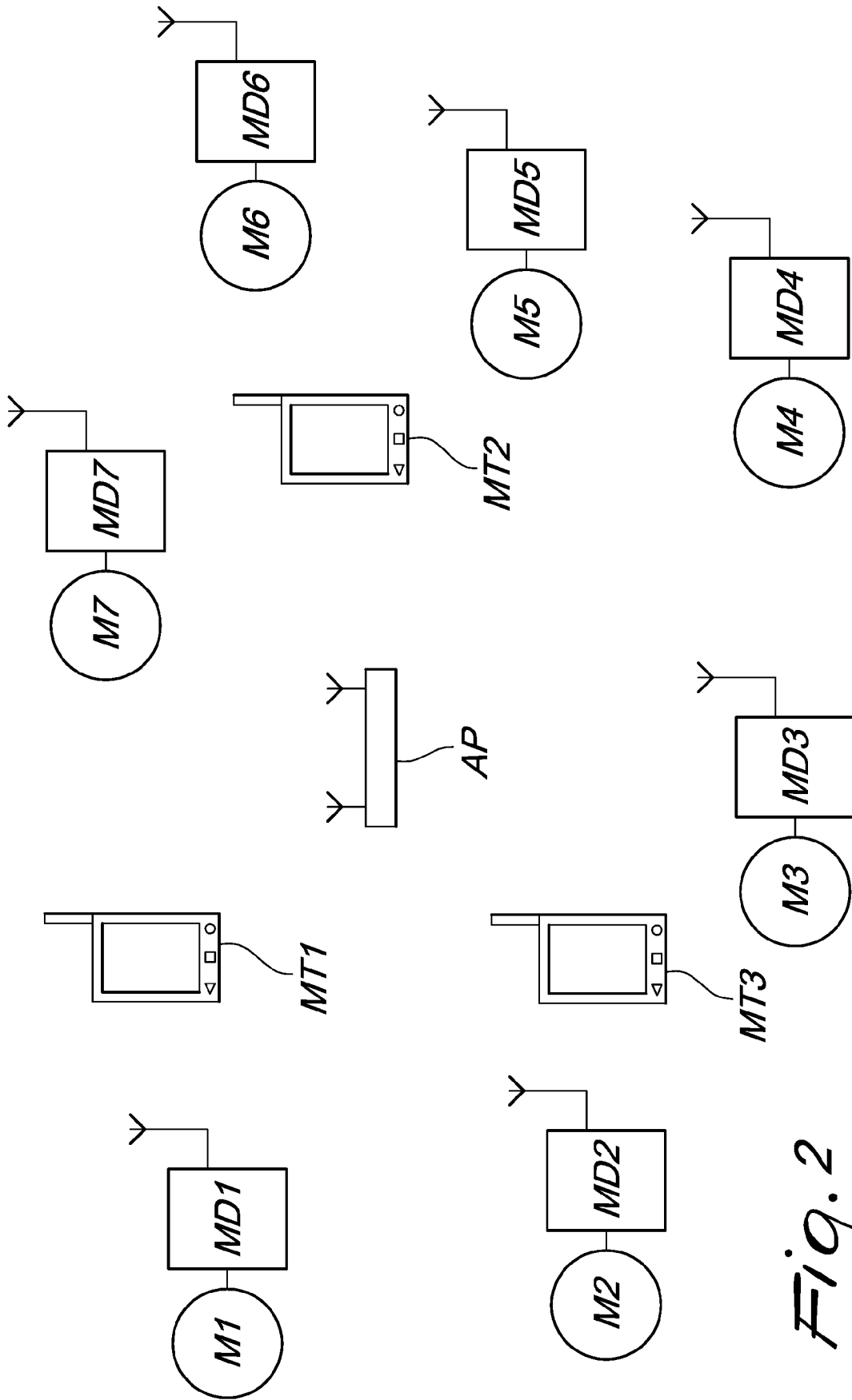


Fig. 2

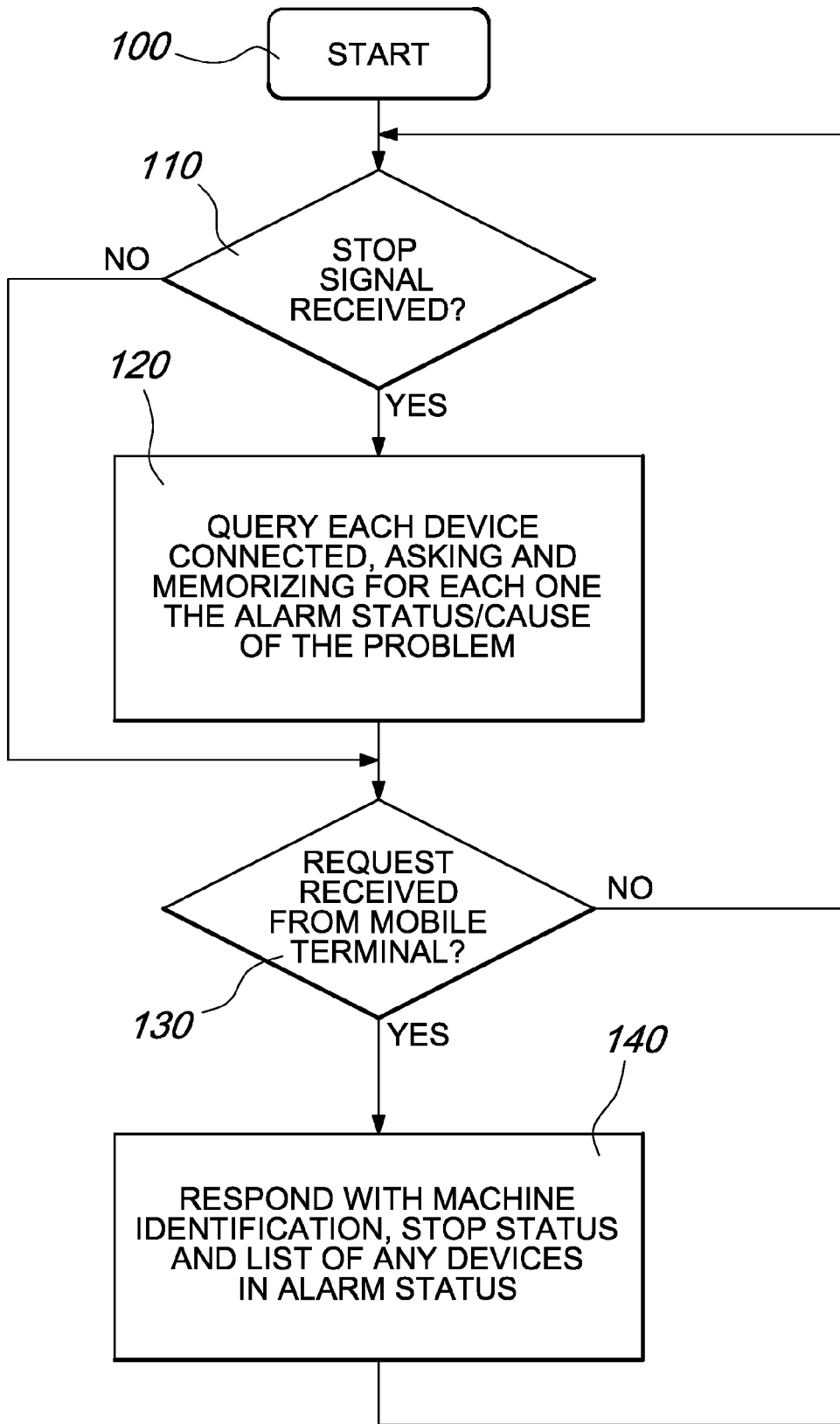


Fig. 3



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Application Number
EP 16 16 8483

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 19 October 2016	Examiner Sterle, Dieter
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ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.

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