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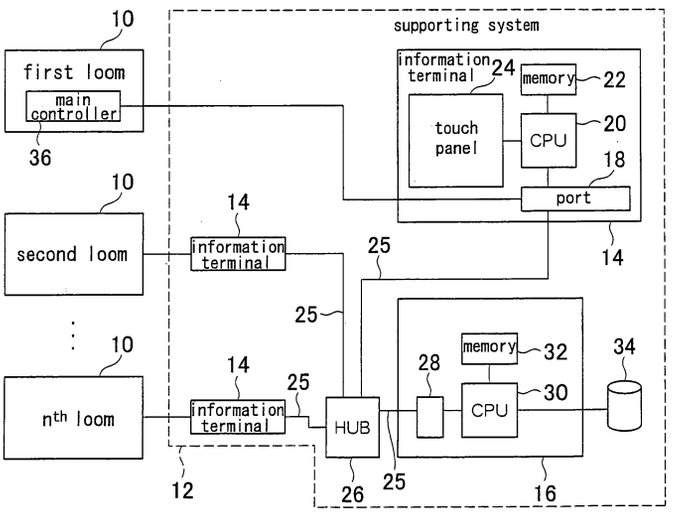
(54) Method of supporting textile machinery and supporting apparatus

(57) A method of supporting textile machinery comprises: a storing step (ST003) for storing yarn troubles occurring in the textile machinery (10) and times of occurrence of the yarn troubles as storage information; an analyzing step (ST104, ST105) for selecting one of plural trouble occurrence patterns different in time sequence of the yarn troubles on the basis of the storage information through an information terminal in a loom in an operation for specifying the causes of yarn troubles and making the selected trouble occurrence patterns answers; a managing information extracting step (ST108) for extracting managing information from a database where plural pieces of managing information concerning yarn troubles are pre-accumulated so as to be extracted on the basis of the answers and in correspondence to the answers; and a managing information indicating step (ST110) for indicating the managing information in the information terminal (14).

Fig. 1



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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a method and system for supporting textile machinery.

Description of Prior Art

[0002] As a loom which is one of textile machinery, an art to obtain the number of stoppages as operating information for controlling operation of the loom and to indicate the same in an information terminal of the loom (see, for example, Patent Document 1) is known. Herein, the number of stoppages means the number per unit hour of the loom stoppages. The number of stoppages is counted every time the loom stops and for each kind of yarn application to be indicated in an information terminal. As kinds (applications) of yarn, there are, for example, weft yarn, warp yarn, selvedge yarn, etc.

[0003] When the number of stoppages due to yarn trouble increases, an operator inspects the loom, based on an instruction manual provided by a loom manufacturer or his own experience so as to remove a fundamental cause which increased the number of stoppages.

[0004] The problem is, however, that there are so many items for checking the loom that it takes much time to finally remove deficiency.

[0005] As a system for supporting adjustment of a loom to settle such a problem, a so-called expert system is known (see, for example, Patent Documents 2 and 3).

Patent Document 1: Japanese Patent Appln. Public Disclosure No. 9-195145
Patent Document 2: Japanese Patent Appln. Public Disclosure No. 4-41746
Patent Document 3: Japanese Patent No. 2934026

[0006] However, since support information to be indicated is based on a state of the loom when it stopped, even such a system only indicates all the causes to be supposed from the state of the loom when it stopped. As a result, an operator should continue his inspection according to the indication until he comes to discover a fundamental cause, and it takes much time until the cause of stoppage is finally removed.

[0007] Such a problem is caused not only to a loom but also to a warp preparatory machine such as a warper, a warp sizer and the like.

SUMMARY OF THE INVENTION

[0008] An object of the present invention lies in indicating proper managing information enabling to promptly remove yarn trouble factors.

[0009] The method for supporting textile machinery according to the present invention comprises: a storing step for storing as storage information yarn troubles caused in the textile machinery and the time of their occurrence; further, in a work for specifying the causes of the yarn troubles, an analyzing step for selecting one of a plurality of trouble occurrence patterns different in time sequence of the yarn troubles based on the storage information through an information terminal provided in the textile machinery and using the selected trouble occurrence pattern as an answer; a managing information extracting step for extracting as a result of extraction of the managing information on the basis of the answer from a database where plural pieces of managing information concerning the yarn troubles are preaccumulated; and a managing information indicating step for indicating the managing information in the information terminal.

[0010] The information terminal preferably includes: an indicator for indicating the occurrence of the yarn trouble based on the storage information together with a time sequence axis and a situation of occurrence; an input device having selection keys corresponding to a plurality of trouble occurrence patterns different in time sequence of the yarn troubles and for having an operator input the answer. The analyzing step further includes having the operator judge whether the situation of occurrence indicated in the indicator correspond to one of the trouble occurrence patterns and having him select by using the selection key corresponding to the trouble occurrence pattern.

[0011] The trouble occurrence pattern preferably includes a concentration pattern which shows the pattern is concentrically generated in a certain time zone and a dispersion pattern which shows the pattern is dispersively generated as a whole.

[0012] More concretely, a warping machine or a warp take-up device for taking up the warp from a creel or a plurality

of sectional beams, a warp preparatory machinery such as a warp sizer and a loom can be thought of as the above-mentioned textile machinery. As a more suitable loom, there are shuttleless looms such as a rapier loom, a fluid-jet loom and the like.

[0013] Preferably, a loom, one of the textile machinery, is capable of multicolor weft yarn insertion, the yarn trouble is either mis-insertion or breakage in weft supply, and the above-mentioned trouble occurrence patterns include trouble occurrence patterns generating by a specific kind of weft and patterns generated irrespective of the kind of weft.

[0014] The method of supporting textile machinery with respect to a loom further comprises a selecting step for having the indicator indicate the number of occurrence in correspondence to kinds of the yarn troubles and having an operator select a kind of the yarn troubles in correspondence to the number of occurrence. The selecting step may be carried out before the analyzing step.

[0015] The method of supporting textile machinery with respect to a loom comprises an inquiring step for inquiring, when the yarn trouble concerns faulty weft insertion or a breakage in weft supply, to specify the main cause of the yarn trouble which an operator grasps, and this inquiring step may be carried out after the analyzing step.

[0016] The method of supporting textile machinery with respect to a loom includes a warp position selecting step for having information relative to a position of occurrence of the yarn trouble in the warp direction indicated in the information terminal and having an operator select the position. This warp position selecting step may be carried out after the analyzing step.

[0017] The apparatus for supporting textile machinery comprises: an information terminal provided in textile machinery and provided with an input device and an indicator; a storage portion for storing as storage information yarn troubles and the times when the yarn troubles occurred; and a managing supporter connected to the information terminal so as to transmit or receive the information. The managing supporter is connected to a database which accumulates plural pieces of managing information concerning yarn troubles; the storage portion is provided so as to transmit and receive information to and from the information terminal. The information terminal carries out the storing step for storing as storage information the yarn troubles caused in the textile machinery and the times of occurrence of the yarn troubles, and the managing supporter carries out, in a work for specifying the causes of the yarn troubles, an analyzing step for selecting one of plural trouble occurrence patterns different in time sequence of the yarn troubles on the basis of the storage information through the information terminal provided in the textile machinery, and using the selected trouble occurrence pattern as an answer; and a managing information extracting step for extracting as a result of extraction of the managing information on the basis of the answer, and the information terminal carries out a managing information indicating step for indicating the managing information in the information terminal.

[0018] The information terminal is preferably provided in the textile machinery in one-to-one correspondence, and the managing supporter is connected to the plural information terminals.

[0019] According to the present invention, during operation of the textile machinery, the supporting apparatus of the textile machinery stores yarn troubles and the times of occurrence of the yarn troubles as storage information, and one of a plurality of trouble occurrence patterns different in time sequence of the yarn troubles are selected on the basis of the storage information.

[0020] In specifying a fundamental true cause of the yarn troubles, situations of occurrence of the yarn troubles are judged in time sequence, and one of the plural pieces of the managing information are extracted from a database storing a plurality of pieces of the managing information concerning the yarn troubles on the basis of the selection information of the trouble patterns generated in time sequence as judged in the forgoing, so that the managing information is narrowed, and the managing information indicated in the information terminal is accurate in comparison with managing information obtained by a conventional method.

[0021] Consequently, even in case where an operator with a little experience in adjustment of textile machinery or factory management (management of yarn quality) specifies a cause of yarn trouble to adjust the textile machinery, the operator can promptly carry out proper management according to such an indication in the information terminal, thereby shortening time of the stoppage and improving the productivity of textiles.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022]

Fig. 1 is a block diagram showing one embodiment of the system for supporting textile machinery according to the present invention.

Fig. 2 is a block diagram of the loom shown in Fig. 1.

Fig. 3 is a flow chart showing one of procedures of the method of supporting the loom according to the present invention.

Fig. 4 is a flow chart showing the other procedure of the method of supporting the loom shown in Fig. 3.

Fig. 5 is a flow chart continuing from Fig. 4.

Fig. 6 is a view showing an image plane of the information terminal according to the flow charts in Figs. 3 through 5.
Fig. 7 is a view showing the image plane continuing from Fig. 6.
Fig. 8 is a view showing the image plane of the information terminal continuing from Fig. 7.
Fig. 9 is a view showing the image plane of the information terminal continuing from Fig. 8.
Fig. 10 is a view showing the image plane of the information terminal continuing from Fig. 9.
Fig. 11 is a view showing the image plane of the information terminal continuing from Fig. 10.
Fig. 12 is another view showing the image plane of the information terminal continuing from Fig. 6.
Fig. 13 is a view showing the image plane of the information terminal continuing from Fig. 12.
Fig. 14 is a view showing the image plane of the information terminal continuing from Fig. 13.
Fig. 15 is a view showing the image plane of the information terminal continuing from Fig. 14.

PREFERRED EMBODIMENT OF THE INVENTION

[The loom and the support system]

[0023] Referring to Figs. 1 through 3, a support system (supporting apparatus) 12 for supporting a plurality of looms 10 comprises information terminals 14 provided in the looms 10 in one-to-one correspondence, and a managing supporter 16 connected to the information terminals 14 so as to transmit and receive information.

[0024] The information terminals 14 in the following embodiments have also functions of a so-called setting device of the looms 10 for inputting set values in controllers of the looms such as a main controller 36 as mentioned later and indicating the information of the looms. The information terminal 14 may, however, be provided independently of the setting device of the loom 10.

[0025] As shown in Fig. 1, each information terminal 14 provided in one-to-one correspondence to each loom 10 has a touch panel 24, a port 18 for transmitting and receiving information to and from the managing supporter and the main controller 36, and a memory 22 for inputting set values as the setting device of the loom 10, for indicating the information transmitted from each controller, and for storing programs for handling when transmitting or receiving the information to and from the managing supporter 16.

[0026] Details will be mentioned later, but various sensors of the loom such as a weft feeler, a warp breakage sensor, etc., are connected to the main controller 36. When these sensors become abnormal during driving of the loom 10, the main controller 36 promptly stops the loom, and the information of the detected abnormality, that is, yarn trouble information is inputted to a central processing unit (CPU) 20 through the port 18 of the information terminal 14.

[0027] The central processing unit 20 stores the inputted yarn trouble information together with the time of occurrence as mentioned later in a memory 22 serving as a storing portion.

[0028] The central processing unit 20 outputs the information from the memory 22 or the managing supporter 16 to the image plane of the touch panel 24, and also outputs selection information selected by an operator by pressing the image plane of the touch panel 24.

[0029] The image plane of the touch panel 24 serves as an input device and an output device. In stead of the touch panel 24, however, a push button can be used as an input device, and a liquid crystal display as an output device. It is also possible to use a display capable of multicolor indication.

[0030] The information terminal 14 is connected to the managing supporter 16 provided in common in at least one of the information terminals by a network cable 25. The network is constituted by using network cables 25 and a hub 26. The network cable 25 which is connected to each information terminal 14 and the network cable 25 which is connected to the managing supporter 16 are temporarily connected to a hub 26 to communicate to each other. The managing supporter 16 is disposed, for example, in a control room of a weaving factory.

[0031] The managing supporter 16 includes, for example, a computer such as a personal computer on the market or the like. More concretely, the managing supporter 16 is connected to a database 34 for detectably storing the managing information to cope with yarn troubles. The managing supporter 16 has a central processing unit (CPU) 30 for outputting the information concerning yarn troubles to each information terminal 14 through the port 28 and receiving the yarn trouble information outputted from each information terminal 14 as well as the selection information selected by an operator through the port 28.

[0032] The central processing unit 30 transmits or receive information to or from the memory 32 and the database 34 in compliance with a demand from each information terminal 14 or for outputting command to each information terminal 14.

[0033] The database 34 holds the managing information corresponding to the warp or weft troubles such as shown in Table 1. The managing information held by the database 34 can be rewritten by utilizing renewal information provided by a manufacturer or information obtained based on a user's experience through a keyboard (not shown).

[0034] Incidentally, the computer 30 constituting the managing supporter 16 can be additionally provided with such publicly known functions, besides a function as a supporting system (a so-called expert system) for providing the

managing information concerning the above-mentioned yarn troubles, as, for example, an operating condition tabulating function for tabulating the number of loom stoppage or the rate of operation and outputting an operation report, a function for storing the weaving condition of the loom for each style No. of a cloth and feeding such information in compliance with a demand from the information terminal side.

[Table 1]

Kind of Yarn Trouble	Mode of Detection	Corresponding Sensor
Weft	Weft mis-insertion (tip has not reached cloth end), e.g., short pick, warp looping, etc.	H1 feeler
Weft	Blow-off, long pick (reaching a position normally not to be reached)	H2 feeler
	Breakage in supply	Package sensor (Disposed in each weft package)
Warp	Yarn breakage	Dropper
Selvedge Yarn	Yarn breakage, slack	Yarn breakage sensor
Catch Cord	Yarn breakage, slack	Yarn breakage sensor

[0035] As shown in Fig. 2, the loom 10 is an air-jet loom using compressed air as a weft insertion fluid. The loom 10 reserves the weft 38 wound around a weft package 37 in a length measuring and storage unit 40, releases the reserved weft 38 pick by pick by means of a releasing pin 42, inserts the released weft 38 by jetting fluid from a main nozzle 44 into a shedding of the warp 46 and selvedge yarns 48, and beats the inserted weft 38 against a cloth fell by a reed 50.

[0036] The loom 10 shown in Fig. 2 is an example of a one-color weft insert loom. In case of a multicolor weft insert

loom, a plurality of packages 37, package sensors 56, length measuring units 40, release pins 42 and main nozzles 44 are provided in correspondence to the weft kinds.

[0037] Whether or not the weft 38 is correctly inserted is judged on the basis of detection signals S1 and S2 of an H1 feeler sensor 52 and an H2 feeler sensor 54 disposed on an opposite side of weft insertion side (weft arrival side).

[0038] Here, the two feeler sensors 52 and 54 are optical sensors forming their detection zones in a weft flying path. More particularly, the H1 feeler sensor 52 is provided near the cloth end on the weft arrival side and detects whether or not the weft arrived at the cloth end on the weft arrival side. It is judged on the basis of a detection signal of the H1 feeler sensor 52 whether the weft was inserted or not. The H2 feeler sensor 54 is positioned more downstream for the insertion than the H1 feeler sensor is, and detects a so-called long pick and a blown-off end of the weft during the insertion. Whether or not the weft is correctly inserted is judged, based on a detection signal of the H2 feeler sensor 54.

[0039] Whether the weft 38 is broken or short of supply or not is judged on the basis of a detection signal S3 from a package sensor 56 disposed between the weft package 37 and the length measuring and storage unit 40.

[0040] Whether the warp 46 and the selvedge yarn 48 are broken or not is judged on the basis of a detection signal from a warp sensor (not shown) and a selvedge yarn sensor (not shown), respectively.

[0041] When judged that a yarn trouble occurred, the main controller 36 stops the loom 10 based on the detections signals S1, S2, S3, etc., immediately and outputs to the information terminal 14 a yarn trouble signal indicating that a yarn trouble occurred.

[0042] The yarn trouble signals include information for discriminating kinds of yarn troubles of the warp or the weft, and the like, and a weft selection Nos. corresponding to the kinds of the weft so as to match a multicolor weft insertion in case of the weft.

[0043] The supporting system 12 of the foregoing loom 10 works as follows.

[Under normal operation]

[0044] As shown in Fig. 3, when an operator drives the loom 10, the information terminal 14 monitors occurrence or non-occurrence of yarn troubles until the period of weaving operation of the loom 10 terminates, and carries out a storing step for storing as the storage information the kinds of the yarn trouble and the time of occurrence thereof which are outputted from the main controller 36 when a yarn trouble occurs.

[0045] The information terminal 14 judges whether a period of weaving operation of the loom 10 finished or not (step ST001). In case the period of weaving operation of the loom 10 finished, the storing step terminates.

[0046] When the loom 10 is under operation, namely, in a period of weaving operation, the information terminal 14 judges whether a yarn trouble signal that a yarn trouble occurred was received or not from the main controller 36 (step ST002). When judged that no yarn trouble occurred, it returns to step ST001.

[0047] The information terminal 14, when judging a yarn trouble occurred, makes the memory 22 store the kind of yarn trouble as to whether it is a warp yarn trouble or a weft yarn trouble and the time of occurrence as the storage information (step ST103). Thereafter, it returns to step ST001 to judge whether the operation of the loom 10 has not terminated.

[0048] As mentioned above, during a weaving operation, namely, during the operation of the loom 10, the information terminal 14 carries out the storage step for storing the yarn trouble and the time of occurrence thereof when the yarn trouble occurs.

[0049] The above-mentioned period of weaving operation of the loom can make the time when a continuous operation of the loom after looming and gaiting are done as a starting point and the time when the amount of the warp wound round the warp beam runs short as an end point.

[0050] The memory 22 can maintain the stored storage information even after the weaving operation period ends. Also, at the starting point of weaving a next cloth, the storage information for the previous cloth can be erased.

[Method of indicating managing information to cope with the cause of weft troubles]

[0051] Firstly, an explanation is given on a method of indicating managing information to cope with the cause of weft troubles (a series of processes).

[0052] As shown in Figs. 4 and 5, a loom operator sees, for example, a report on the number of stoppage (not shown) indicated in the touch panel 24 of the information terminal 14 during the weaving operation, and stops operating the loom 10 by operating an operation stop button (not shown) when judging there are too many yarn troubles occurring during the operation of the loom 10 (step ST101).

[0053] The operator, then, operating the information terminal 14, makes a "navigation image plane" indicated on the image plane of the touch panel 24 (see Fig. 6).

[0054] The CPU 20 controls the touch panel 24 so as to display on the image plane thereof buttons B1 and B2 for selecting in which of the weft and the warp the yarn trouble occurred.

[0055] By this, the operator selects which of the weft and the warp yarn troubles frequently occurred, by pushing the button B1 or button B2 (step ST102) selectively.

[0056] A series of indication processes including such an early indication process can be carried out by a process program stored in the memory 22. Following the above-mentioned selecting operation, the information terminal 14 starts to transmit and receive a series of information on extraction of the managing information of the yarn troubles by the managing supporter 16. As the first process, the information terminal 14 transmits to the managing supporter 16 the selection information as to which of the warp and the weft is selected as an object.

[0057] Next, when the operator pushes the button B1 of the weft, based on his judgment on the number of yarn troubles that there are more weft troubles, the information terminal 14 reads out from the memory 22 the storage information concerning the occurrence of the weft trouble, and displays on the image plane of the touch panel 24 a relation between the kinds of the weft and sensors which caused stoppage in array together with buttons B3, B4 and B5 for the operator to select (see Fig. 7). This makes the operator carry out the selection step for selecting a kind of weft from a plurality of kinds to which stopping occurred many times (step ST103).

[0058] "H1," "H2" and "P" in the image plane of the touch panel 24 shown in Fig. 7 respectively represent the H1 feeler sensor 52, H2 feeler sensor 54 and package sensor 56. Also, "C1" through "C8" represent Nos. of the weft insert devices corresponding to the kinds of the weft, namely, Nos. of the main nozzles 44.

[0059] The operator, seeing the image plane of the touch panel 24 shown in Fig. 7, pushes any one of the buttons B3, B4 or B5 corresponding to the sensors 52, 54 or 56 which caused frequent stops selectively. Thus, the information terminal 14 has the operator select the kinds of yarn troubles as objects for extracting managing information to carry out in correspondence to the frequency of occurrence.

[0060] Next, when the operator selects the button B3 corresponding to "H1" which caused frequent troubles, the number of occurrence and the corresponding pattern of trouble occurrence are indicated in the image plane of the touch panel 24 (step ST104).

[0061] In an area A1 on the right side of the image plane of the touch panel 24 is shown by a bar graph the number of yarn troubles detected by the H1 feeler 52 in a period from the present back to the past twenty four hours before.

[0062] In an area A2 on the right side of the image plane of the touch panel 24 are indicated a plurality of time sequence axes divided every two hours as a unit time section. In the area A2 are marked short vertical lines at positions of the time sequence axes corresponding to the times of occurrence of yarn troubles detected by the H1 feeler 52. There are twelve sections from the present to the past indicated as such unit time sections, namely, twenty-four hours indicated in plural stages downward in the image plane with the present time as a reference.

[0063] To explain about the area A2 concretely, "0," "- 2," ... "- 24" shown on both sides of the rectangular area show the time axes, and for example, "- 2" means two hours ago from the present.

[0064] The area A2 consists of twelve stages such as the time axis from "0" to "- 2," the time axis from "- 2" to "- 4," the time axis from "- 4" to "- 6," ..... the time axis from "- 22" to "- 24". "0" on the upper right hand means the present, and toward the left side, whether or not there were yarn troubles is shown. The state from the present to two hours ago is shown at the left end of the uppermost stage, and the state from the present to three hours ago is shown in the middle position between "- 4" and "-2" which is on the second stage from the top.

[0065] In the example shown in Fig. 8, it is understood that yarn troubles occurred in a short period about twenty minutes ago. Also, it is understood that there were three times of yarn troubles about three hours and thirty minutes ago.

[0066] The operator, seeing the image planes shown in the areas A1 and A2, selects buttons B6 - B9 (step ST105). The buttons B6 - B9 serve as selection keys.

[0067] Concretely, when the operator, seeing the image planes shown in the areas A1 and A2, judges that there are more yarn troubles in the specific main nozzle 44, namely, of a specific kind of yarn, than other kinds of weft, or that the times of occurrence of the yarn troubles concentrate, pushes the button B6.

[0068] When the operator, seeing the image planes shown in the areas A1 and A2, judges that the number of yarn troubles of a specific main nozzle 44, namely, a specific weft yarn, is more than that of other kinds of weft, or that the times of occurrence of the yarn troubles are dispersed, selects the button B7.

[0069] When the operator, seeing the image planes shown in the areas A1 and A2, judges that all the main nozzles 44, namely, the numbers of occurrence of yarn troubles of all the weft yarns are approximately the same and that the periods of occurrence of yarn troubles concentrate, pushes the button B8.

[0070] When the operator, seeing the image planes shown in the areas A1 and A2, judges that the numbers of the specific nozzles 44, namely, the numbers of yarn troubles of specific weft yarns are approximately the same and that the times of occurrence of yarn troubles are dispersed, selects the button B9.

[0071] In this case, when the operator, seeing the analysis shown in the area A1, judges that the number of occurrence of troubles of the weft corresponding to No. "3" of the main nozzle 44 is more than the number of occurrence of troubles of another weft yarn, and seeing the analysis indicated in the area A2, judges that abnormal detections by the weft stop H1 feeler 52 are dispersed in general, operates to select a corresponding selection button B7.

[0072] According to the selection by the selection button B7, the information terminal 14 transmits the selection

information that the selection button B7 was selected as information of analyzed trouble occurrence patterns in time sequence to the managing supporter 16.

[0073] The managing supporter 16, upon receipt of such information, starts a series of processes for extracting managing information to cope with the yarn trouble. The managing supporter 16 transmits, as the first step, inquiry information for further specifying the main cause of the yarn trouble to the information terminal 14.

[0074] Next, as shown in Fig. 9, the information terminal 14 displays in the image plane of the touch panel 24 a list of main causes of the yarn troubles as well as selection buttons B10 - B14.

[0075] Since the buttons B10 - B14 corresponding to the main causes of the yarn troubles are indicated in the image plane of the touch panel 24, the operator can select the selection buttons B10 - B14 corresponding to the contents of the yarn troubles, based on heretofore states of restoration such as a weaver's memory. Thereby, a first dialog step is carried out (step ST106).

[0076] The image plane of the touch panel 24 shown in Fig. 9 can show the main causes of the yarn troubles not only with letters but also with simple drawings showing trouble modes so that the operator can make correct selections.

[0077] Then, the operator grasps from the weaver's memory that the most part of the yarn troubles is a "front end trouble" caused by the front end of the weft staying within a warp shedding and not arriving at a cloth fell. The operator who grasped the contents of most of the yarn troubles selects the selection button B12 in response to this inquiry. By this, the information terminal 14 transmits to the managing supporter 16 the selection information as an answer to the inquiry.

[0078] Also, the managing supporter 16, receiving such information, sends inquiry information, as the next step, concerning the mode of time-based occurrence of this trouble to specify the main cause of the yarn trouble to the information terminal 14.

[0079] Next, as shown in Fig. 10, a list of states of occurrence of yarn troubles as well as the corresponding selection buttons B15, B16 are indicated in the image plane of the touch panel 24, and an operator, for example, based on his memory of the states for past several days, selects either the selection button B15 or B16 that seems proper. Thereby, a second dialog step is realized (step ST107).

[0080] Such a dialog step may be realized not only twice but also once or three times or more. The dialog steps can be properly determined concerning inquiry information to an operator through the information terminal 14 according to kinds of yarn troubles. These can be done likewise concerning warp breakage as mentioned later or yarn breakage other than it.

[0081] The information terminal 14 sends answer information answered in the above step to the managing supporter 16 through the network 25.

[0082] Then, the managing supporter 16, based on the states of occurrence of time-based yarn troubles and the answer information heretofore inputted, carries out managing information extracting step to extract the managing information as a result of extraction from the database in which plural pieces of managing information on yarn troubles are pre-accumulated (step ST108). In this case, in the managing information extracting step, weft troubles are dispersedly caused in time sequence by an H1 feeler, and most of the weft troubles are "front end troubles." So the managing information corresponding thereto is extracted and sent to the information terminal 14.

[0083] Next, the managing supporter 16 carries out a transmitting step to send the extraction result to the information terminal 14 (step ST109).

[0084] Then, the information terminal 14, as shown in Fig. 11, carries out a managing information indicating step to indicate the extraction result sent from the managing supporter 16, namely, the information for coping with the weft trouble, in the image plane of the touch panel 24 (step ST110).

[0085] Thus, since the states of occurrence of yarn troubles are preliminarily judged in time sequence by an operator and the extraction result in which the managing information is extracted on the basis of the answer as judged are indicated in the image plane of the touch panel 24, the managing information indicated in the information terminal 14 is more accurate than that by the conventional method.

[0086] Therefore, even with a little experience in adjustment of the loom 10 or factory control (control of yarn quality), an operator can promptly and properly cope with, thereby shortening the time of stoppage, and improving the cloth productivity.

[0087] Incidentally, Table 2 shows, for example, phenomena, items of states to be confirmed by an operator, probable causes as the managing information and a part of contents of proceeding step.

[0088] According to the managing information to cope with the yarn troubles at this time, because of too many items for confirmation, it takes much time to specify causes of the yarn troubles and to repair.

[0089] On the other hand, when the states of occurrence in time sequence of yarn troubles are in the mode shown in Fig. 8 A2, the items for confirmation are narrowed down on the basis of the information on trouble occurrence patterns analyzed as above (namely, patterns generally dispersed with a specific weft).

[0090] By this narrowing down, irrelevant items among items for coping with probable yarn troubles are excluded from objects of indication in the image plane of the touch panel 24. Also, further items for coping with yarn troubles by

dialogs with the operator such as those mentioned above are excluded from objects of indication in the image plane of the touch panel 24.

[0091] As a result, item for coping with yarn troubles are narrowed down to suitable two items (shown with * outside the frame of Table 2) as shown in Fig. 11. By this, the managing supporter 16 can display the narrowed down items for coping on the image plane of the touch panel 24.

[Table 2]

Front end trouble

Phenomenon	Confirmation of State	Presumed Cause		Proceeding Step	
Arrival is delayed.		Frame height is not proper in a specific frame.	★★	Set frame height at a proper height.	★★
		Problem due to weft supply cutter	★★	Make proper the timing and position of the weft cutter.	★★
		Problem due to weft free end at the tip of the main nozzle	★★★	Adjust a too wide gap between the main nozzle and the cutter to a proper one.	★★★
		Problem due to weft supply	★	Exchange weft packages.	★ *
		Subnozzle pressure is too low.	★★	Raise subnozzle pressure.	★ *
		Preceding angle of the subnozzle is insufficient.	★	Add a preceding angle of 15° to 20°.	★★
Arrival is unstable.	Weft flies out of the reed or flies in the weft flying path formed between projections of the reed.	Velocity value of the reed if improper.	★	Clean the reed. Exchange reeds.	
		Direction of the main nozzle is improper. Faulty cutting by the weft cutter.			
	The weft supply side or the yarn end is fluffy.				
Warp disturbance occurs.	Selvedge yarn on the supply side is slack.	Selvedge yarn tension is insufficient.			
		Faulty warp drawing in the heald			
	Disturbance occurs to the warp from the warp beam to the cloth fell.	Faulty warp drawing in the reed			
		Warp tension is insufficient.			
		Amount of shedding is insufficient.			

[Method of indicating the managing information to cope with causes of yarn troubles]

[0092] Following is an explanation on a method (a series of processes) of indicating the managing information to cope with causes of warp troubles.

[0093] As shown in Figs. 4 and 5, the method of indicating the managing information to cope with causes of warp troubles is the same as the method of indicating the managing information to cope with causes of the weft troubles except the following.

[0094] In step ST102, an operator selects the button B2 by judging that frequent yarn troubles occur to the warp.

[0095] The information terminal 14 reads out stored information concerning occurrence of warp troubles from the memory 22. As shown in Fig. 12, the number of occurrence of yarn troubles and the occurrence of warp troubles are marked and indicated at positions in the time sequence axis corresponding to the times of occurrence in the image plane of the touch panel 24 (step ST104).

[0096] In the area A3 on the left side of the image plane of the touch panel 24, the number of stops is shown in figures. Also, in the area A4 on the right side of the image plane of the touch panel 24, time points when the yarn troubles occurred are shown by short vertical lines.

[0097] The area A4 on the right side of the image plane of the touch panel 24 is the same as the area A2 on the right side of the image plane of the touch panel 24 in Fig. 8.

[0098] The touch panel 24 makes an operator see the image planes shown in the areas A3 and A4, and the operator selects any one of the buttons B20, B21 corresponding to the patterned time-based trouble occurrence patterns (step ST105).

[0099] The managing supporter 16, upon receipt of such information, starts a series of processes for extracting the managing information to cope with the yarn troubles. The managing supporter 16, as the first step, further sends inquiry information for specifying the main cause of the yarn trouble to the information terminal 14. In the managing supporter 16, an inquiring step for asking about a position where the warp was broken is carried out. (step ST201).

[0100] The inquiry step for warp breaking position information, as shown in Fig. 13, makes the information terminal 14 indicate information to urge inputting the positions of occurrence of yarn troubles in the warp direction. An operator selects the positions where the warp troubles occurred in the warp direction by pushing any one of buttons B23 - B27 corresponding to the indicated positions.

[0101] Then, the operator grasps that most part of positions where the warp was broken are "positions from a back roll to a dropper which is a warp breakage sensor." The operator who grasped the fact is to select and operate the selection button B25 in correspondence to the inquiry. Thereby, the information terminal 14 sends the managing supporter 16 the selection information to that effect as an answer to the inquiry.

[0102] The managing supporter 16, upon receipt of such information, sends inquiry information for specifying the details of the yarn breakage states to the information terminal 14.

The information terminal 14 realizes a yarn breakage inquiry step (step ST202). The inquiry step for details of yarn breakage, as shown in Fig. 14, inquires for specifying the details which the operator grasps. The operator selects by pushing any one of the buttons B28, B29 corresponding to what seem to be the positions where main warp trouble occurred, based on his heretofore memory.

[0103] So, the operator, grasping from a weaver's memory that the major part of the detailed state of the warp breakage is "breakage within the beam," will select a selection button B28 as an answer to this inquiry. Thereby, the information terminal 14 transmits the selection information to that effect as an answer to the inquiry to the managing supporter 16.

[0104] Next, the managing supporter 16, based on the states of occurrence of yarn troubles in time sequence as well as on the answer information inputted heretofore, carries out a managing information extracting step (step ST108) for extracting the corresponding managing information as a result of extraction and a transmission step (step ST109), and at the information terminal 14. On the other hand, the information terminal 14 carries out a managing information indicating step (step ST110). In this case, in the managing information extracting step, since warp troubles occur generally dispersedly in time sequence, and yet the major part of the portions where warp breaking occurred are within the warp beam, the managing information corresponding thereto is extracted and fed into the information terminal 14. As a result, the indication shown in Fig. 15 is displayed on the image plane of the information terminal 14, and the operator works to cope with the warp troubles, based on the indication.

[0105] As a result, since the state of occurrence of the warp trouble is prejudged by an operator in time sequence and the result of the extraction of the managing information based on the judged answer is indicated on the image plane of the touch panel 24, the managing information indicated in the information terminal 14 is more accurate than the conventional method.

[0106] Consequently, even an operator with a little experience on adjustment of the loom 10 as well as on factory administration (yarn quality control) can cope with promptly and properly, so that a stoppage time can be shortened, thereby improving the productivity of cloth.

[Other method of supporting]

[0107] The foregoing method of supporting made an operator judge whether or not the state of occurrence indicated in the touch panel 24 corresponds to one of the plural trouble occurrence patterns, but it is possible to make a software judge. More concretely, it is conceivable to make the managing supporter 16 automatically judge based on an analysis result according to a predetermined algorithm.

[0108] In the foregoing embodiment, the selection button to be used when selecting and inputting occurrence patterns in time sequence of yarn troubles indicates not letters but icons which show typical occurrence patterns schematically.

[0109] By indicating icons schematizing topics as such selection buttons, an operator's degree of recognition is improved, and it is advantageous in prevention of so-called input errors.

[0110] While there are provided two such selection buttons corresponding to occurrence patterns in time sequence, that is, occurrence in a specific time zone and occurrence throughout, there may be three or more, depending on states of dispersion.

[0111] In the indications of the number of stoppages and the time-based occurrence of yarn troubles shown in Figs. 8 and 12, the period of indication is not limited to 24 hours as shown but may be every several hours or every several days. Also, while the time is shown in the horizontal axis, the time may be a so-called standard time that is used daily. If there is a holiday, it is more preferable to indicate with the time on the holiday excluded. Also, instead of showing the time on the horizontal axis, the number of weft insert picks may be shown. Those indicated by the horizontal axis are included in the time-based state of occurrence of yarn troubles in this case.

[0112] The above-described embodiment can be varied as follows. A yarn detected by a dropper such as an H1 feeler sensor or a warp breakage sensor is made an object of the foregoing yarn troubles. Other yarn troubles, namely, those detected by an H2 feeler sensor, a package sensor, a selvedge yarn breakage sensor and a catch code breakage sensor may be likewise treated as objects of the yarn troubles. In this case, besides an analysis of states of occurrence of time-based yarn troubles, inquiries from the managing supporter 16 corresponding to the detected yarn troubles may be prepared in the image plane of the touch panel 24.

[0113] As the managing supporter 16, an example of providing one to be used in common with a plurality of looms is illustrated, but each loom may have one managing supporter. Also, the managing supporter 16 may have its function incorporated into the information terminal of the loom. Further, in the illustration, a storage means for storing each yarn trouble together with the time of its occurrence is provided within the information terminal 14, but it is possible to transmit information every time the information terminal 14 calls in response to the call. The location of the storage means is not restricted to that shown in the drawings.

[0114] In the above-mentioned supporting method, an example of selecting the loom as an object, it is not restricted to the example, but the method can be widely applied to a warp preparatory machine such as a warper for taking up a lot of warp yarns round a beam and a warp sizer, as well as to other textile machinery.

[0115] The present invention is not limited to the foregoing embodiments but can be properly modified within a scope of the purport of the present invention.

Claims

1. A method of supporting textile machinery having an information terminal (14) with an information indicating function, comprising:

   a storing step (ST003) for storing yarn troubles which occur in textile machinery (10) together with times of occurrence of the yarn troubles as storage information;
   analyzing steps (ST104, ST105), in an operation to specify causes of the yarn troubles, for selecting one of trouble occurrence patterns different in time sequence of the yarn troubles through said information terminal (14) in said textile machinery (10) on the basis of said storage information, and using the selected trouble occurrence patterns as answers;
   a managing information extracting step (ST108) for extracting said corresponding managing information, from a database where plural pieces of managing information concerning the yarn troubles are pre-accumulated, on the basis of the answers in correspondence to the trouble occurrence patterns as a result of extraction; and
   a managing information indicating step (ST110) for indicating said managing information in said information terminal (14).

2. A method of supporting textile machinery claimed in claim 1, wherein said information terminal (14) includes an indicator for indicating the occurrence of the yarn troubles based on said storage information as states of occurrence together with a time sequence axis, and an input device having selection keys corresponding to a plurality of trouble

occurrence patterns different in time sequence of the yarn troubles and for having an operator input the answers; and

wherein said analyzing steps (ST104, ST105) further includes having an operator judge whether said state of occurrence indicated in said indicator corresponds to one of said plural trouble occurrence patterns and select by the selection key in correspondence to said trouble occurrence pattern.

3. A method of supporting textile machinery claimed in claim 1 or 2, wherein the trouble occurrence patterns include a concentration pattern where the occurrence patterns are concentrated in a certain time zone and a dispersion pattern where the trouble occurrence patterns are dispersed overall.

4. A method of supporting textile machinery claimed in one of claims 1 through 3, wherein said textile machinery (10) is a loom.

5. A method of supporting textile machinery claimed in claim 4, wherein said loom (10) is capable of inserting multicolor weft yarns, wherein said yarn trouble is either weft mis-insertion or weft supply breakage, and

wherein the trouble occurrence patterns further include a pattern occurring to a specific kind of weft yarn and a pattern occurring regardless of kinds of weft yarn.

6. A method of supporting textile machinery claimed in claim 4 or 5, further comprising a selection step (ST103) for indicating the number of occurrence according to the kinds of yarn troubles in said indicator, and for having an operator select the kinds of yarn troubles in correspondence to the number of occurrence through said input device, and

wherein said selection step (ST103) is carried out before said analyzing steps (ST104, ST105).

7. A method of supporting textile machinery claimed in any one of claims 4 through 6,

wherein an inquiry step (ST202) for inquiring for specifying main causes of yarn troubles grasped by an operator is further included, and

wherein said inquiry step (ST202) is carried out after said analyzing steps (ST104, ST105).

8. A method of supporting textile machinery claimed in any one of claims 4 through 6,

wherein said yarn trouble is either warp yarn breakage or selvedge yarn breakage,

wherein a warp position selecting step (ST201) for indicating information concerning positions of the yarn troubles in the warp direction in said information terminal (14) and for having an operator select said positions is further included, and

wherein said warp position selecting step (ST201) is carried out after said analyzing steps (ST104, ST105).

9. A supporting apparatus (12) for supporting textile machinery comprising:

an information terminal (14) having an input device and an indicator and provided in the textile machinery,
a storage portion (22) for storing yarn troubles which caused stoppage and the times when the yarn troubles occurred as storage information, and
a managing supporter (16) connected to said information terminal (14) so as to transmit and receive information;

wherein said managing supporter (16) is connected to the database (34) where plural pieces of managing information concerning yarn troubles are pre-accumulated so as to be extracted in correspondence to the trouble occurrence patterns;

wherein said storage portion (22) is provided so as to transmit and receive information to and from said information terminal (14);

wherein said information terminal (14) carries out a storing step (ST003) for storing yarn troubles occurring in said textile machinery and the times of occurrence of the yarn troubles as storage information;

wherein said managing supporter (16) carries out: analyzing steps (ST104, ST105) for selecting one of plural trouble occurrence patterns different in time sequence of the yarn troubles on the basis of said storage information and making the selected yarn trouble occurrence patterns answers in an operation for specifying causes of the yarn troubles; and a managing information extracting step (ST108) for extracting said managing information as a result of extraction from said database (34) where plural pieces of managing information concerning said yarn troubles are pre-accumulated so as to be extracted in correspondence to said trouble occurrence patterns; and

wherein said information terminal (14) carries out a managing information indicating step (ST110) for indi-

cating the managing information in the information terminal (14).

10. An apparatus for supporting textile machinery claimed in claim 9,
wherein said information terminal (14) is provided in said textile machinery in one-to-one correspondence, and
wherein said managing supporter (16) is connected to the plurality of information terminals (14).

Fig. 1

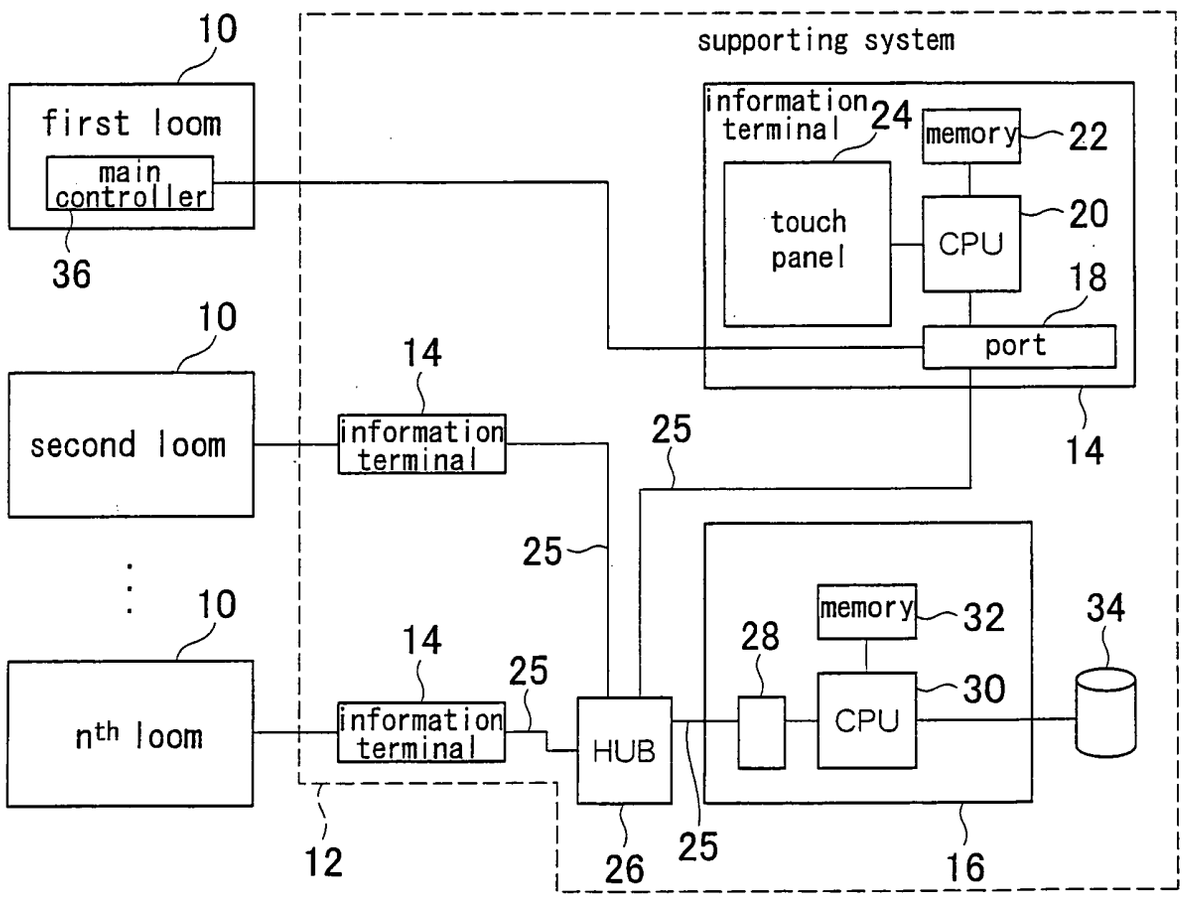

10
first loom
main controller
36
10
second loom
10
nth loom
14
information terminal
14
information terminal
12
supporting system
information terminal
24
memory
22
touch panel
CPU
20
18
port
14
25
25
25
25
memory
32
34
28
CPU
30
HUB
26
16

Fig. 2

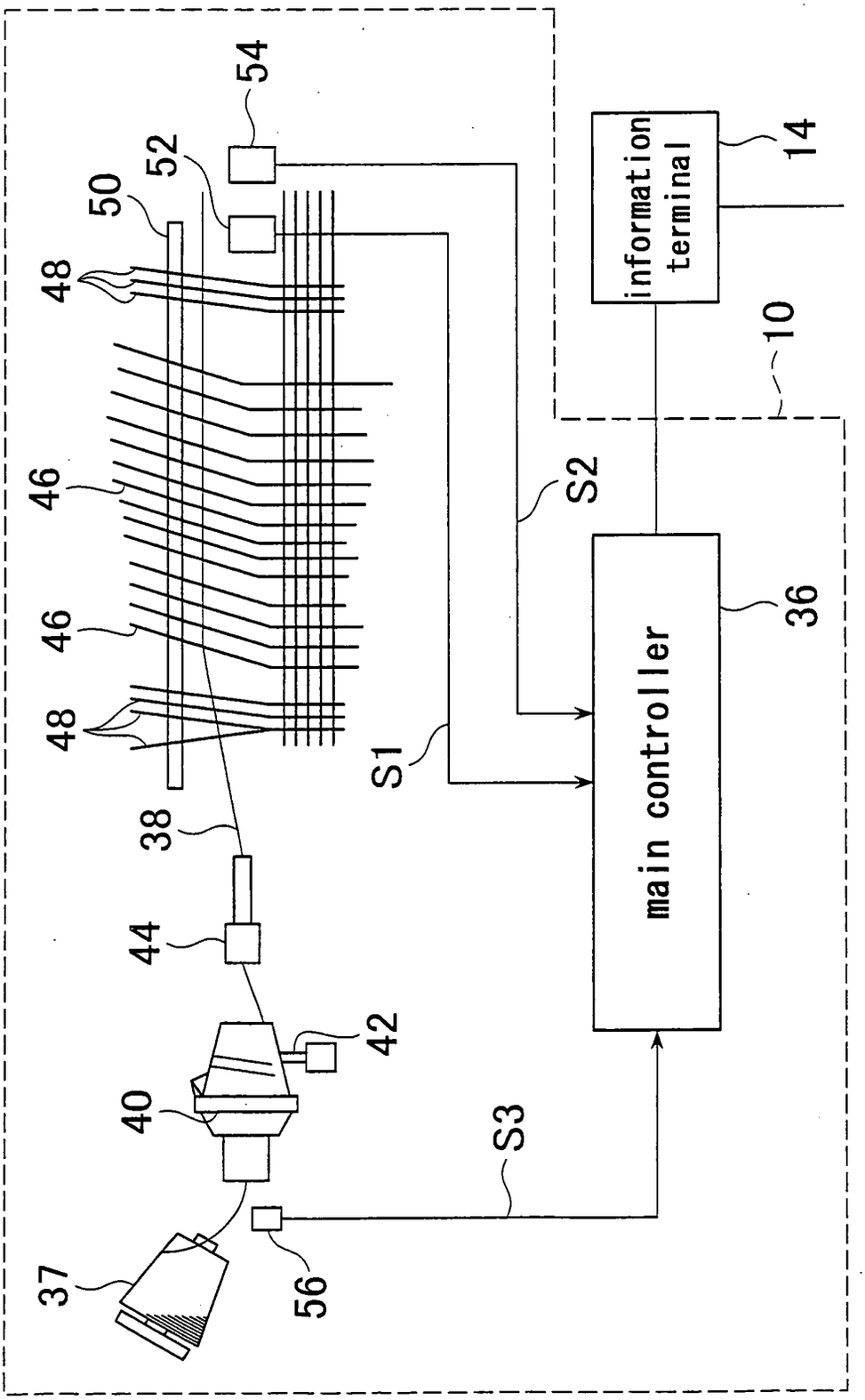

54
52
50
48
46
46
48
38
44
42
40
37
56
S1
S2
S3
main controller
36
10
information terminal
14

Fig. 3

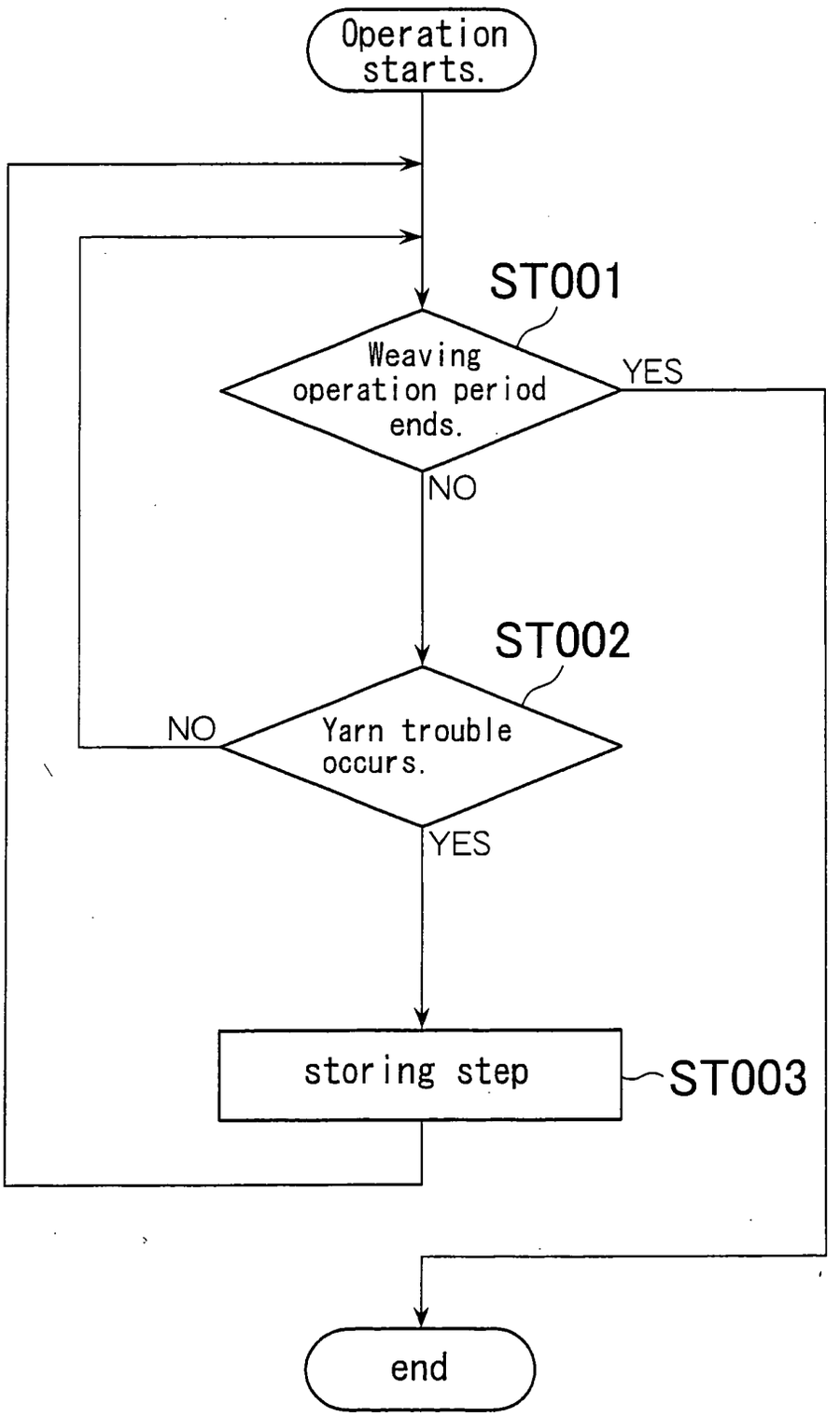

Operation starts.
ST001
Weaving operation period ends.
YES
NO
ST002
NO
Yarn trouble occurs.
YES
storing step
ST003
end

Fig. 4

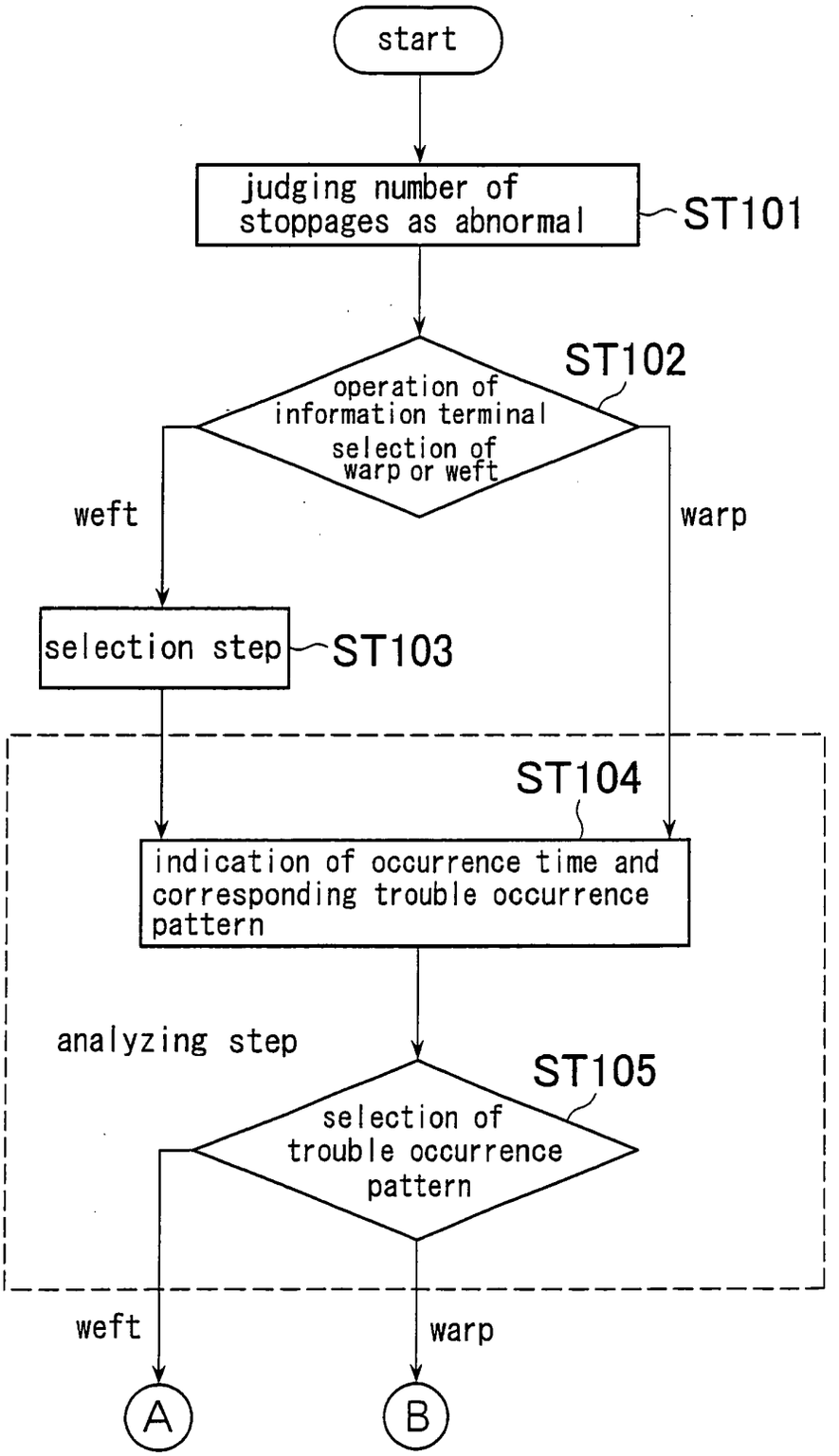

start
judging number of stoppages as abnormal
ST101
ST102
operation of information terminal selection of warp or weft
weft
warp
selection step
ST103
ST104
indication of occurrence time and corresponding trouble occurrence pattern
analyzing step
ST105
selection of trouble occurrence pattern
weft
warp
A
B

Fig. 5

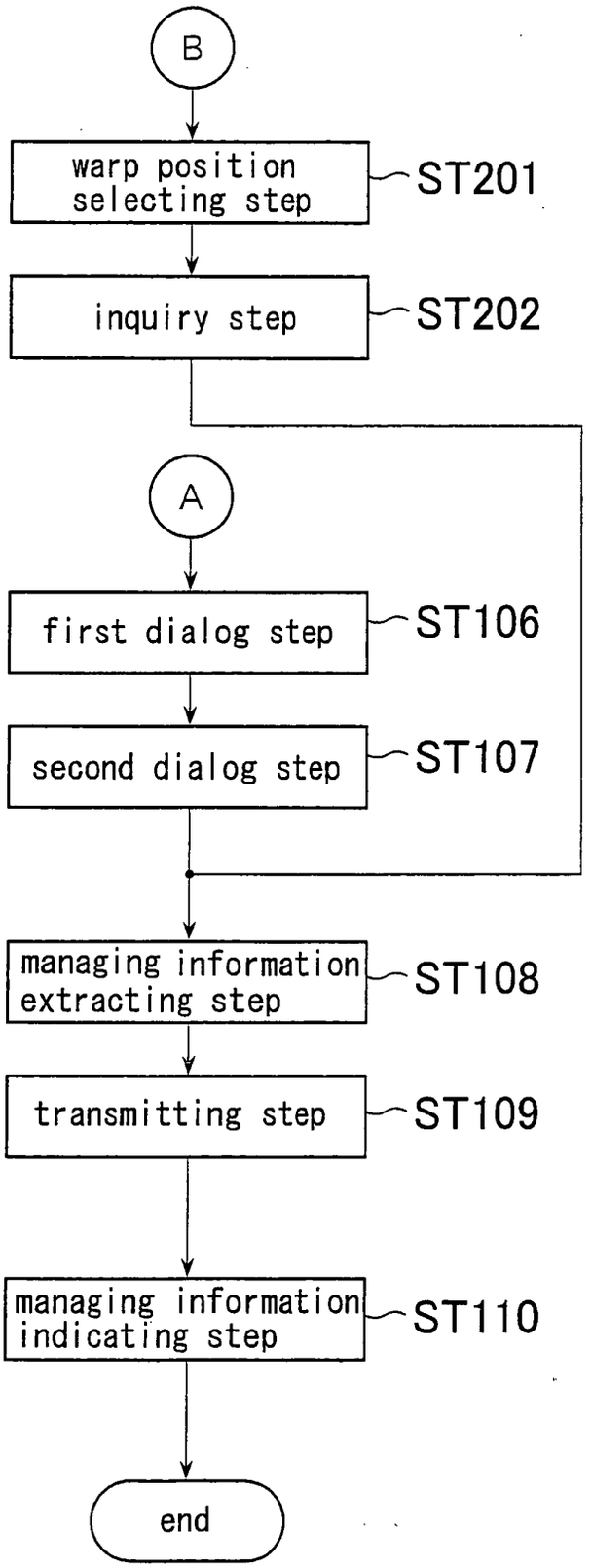

B
warp position selecting step
ST201
inquiry step
ST202
A
first dialog step
ST106
second dialog step
ST107
managing information extracting step
ST108
transmitting step
ST109
managing information indicating step
ST110
end

Fig. 6

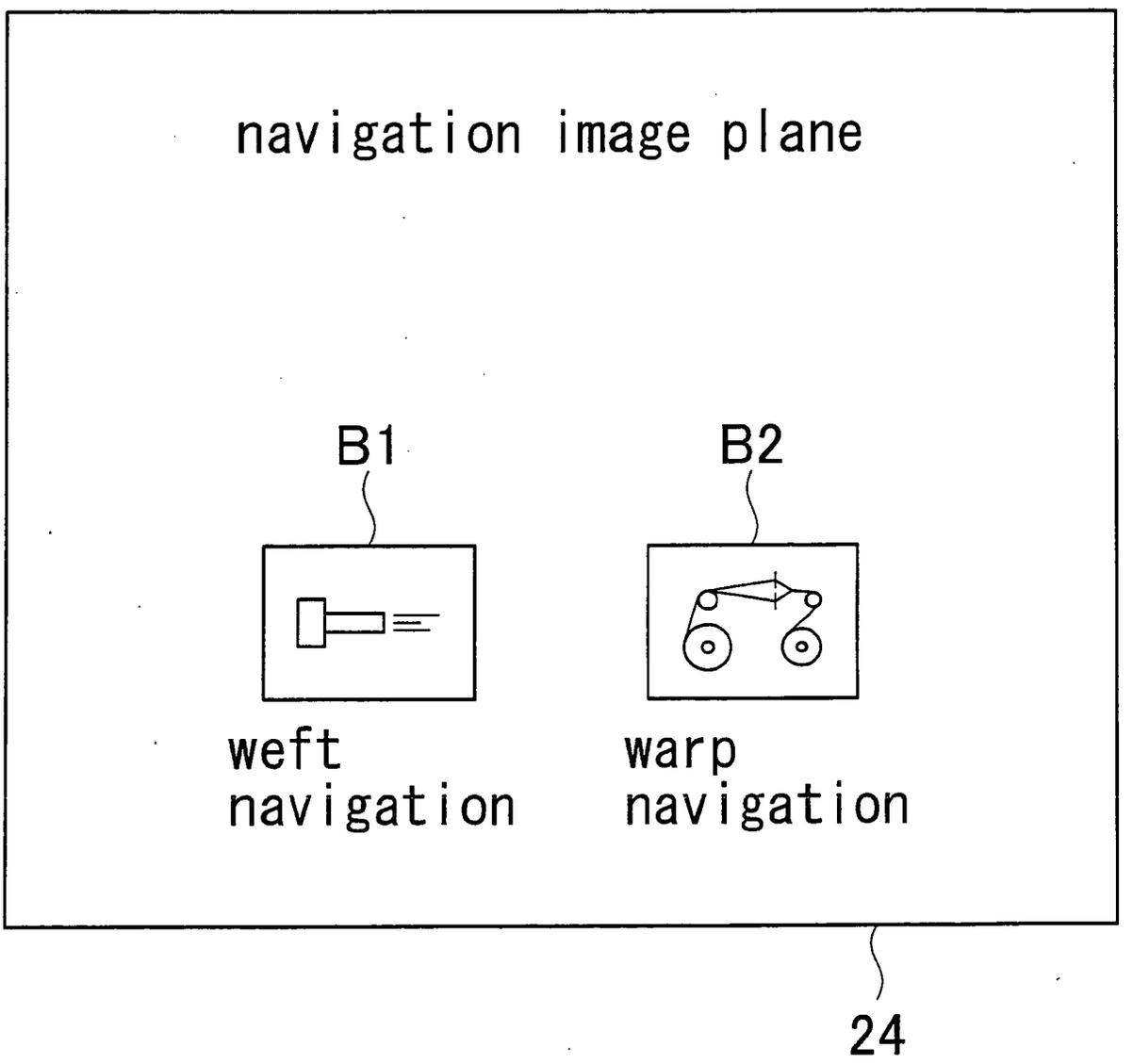

navigation image plane
B1
B2
weft navigation
warp navigation
24

Fig. 7

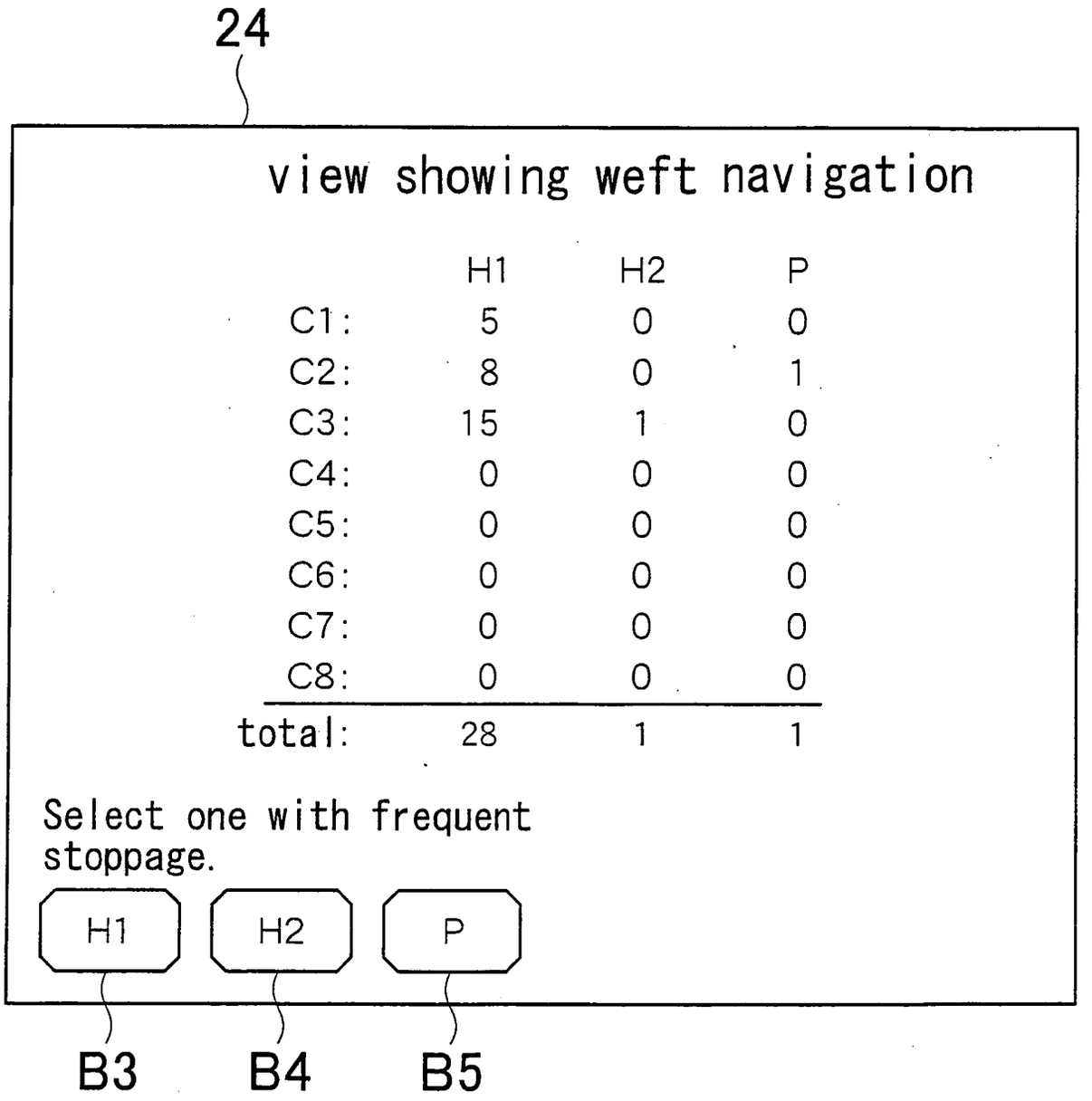

24
view showing weft navigation
H1 H2 P
C1: 5 0 0
C2: 8 0 1
C3: 15 1 0
C4: 0 0 0
C5: 0 0 0
C6: 0 0 0
C7: 0 0 0
C8: 0 0 0
total: 28 1 1
Select one with frequent stoppage.
H1
H2
P
B3
B4
B5

Fig. 8

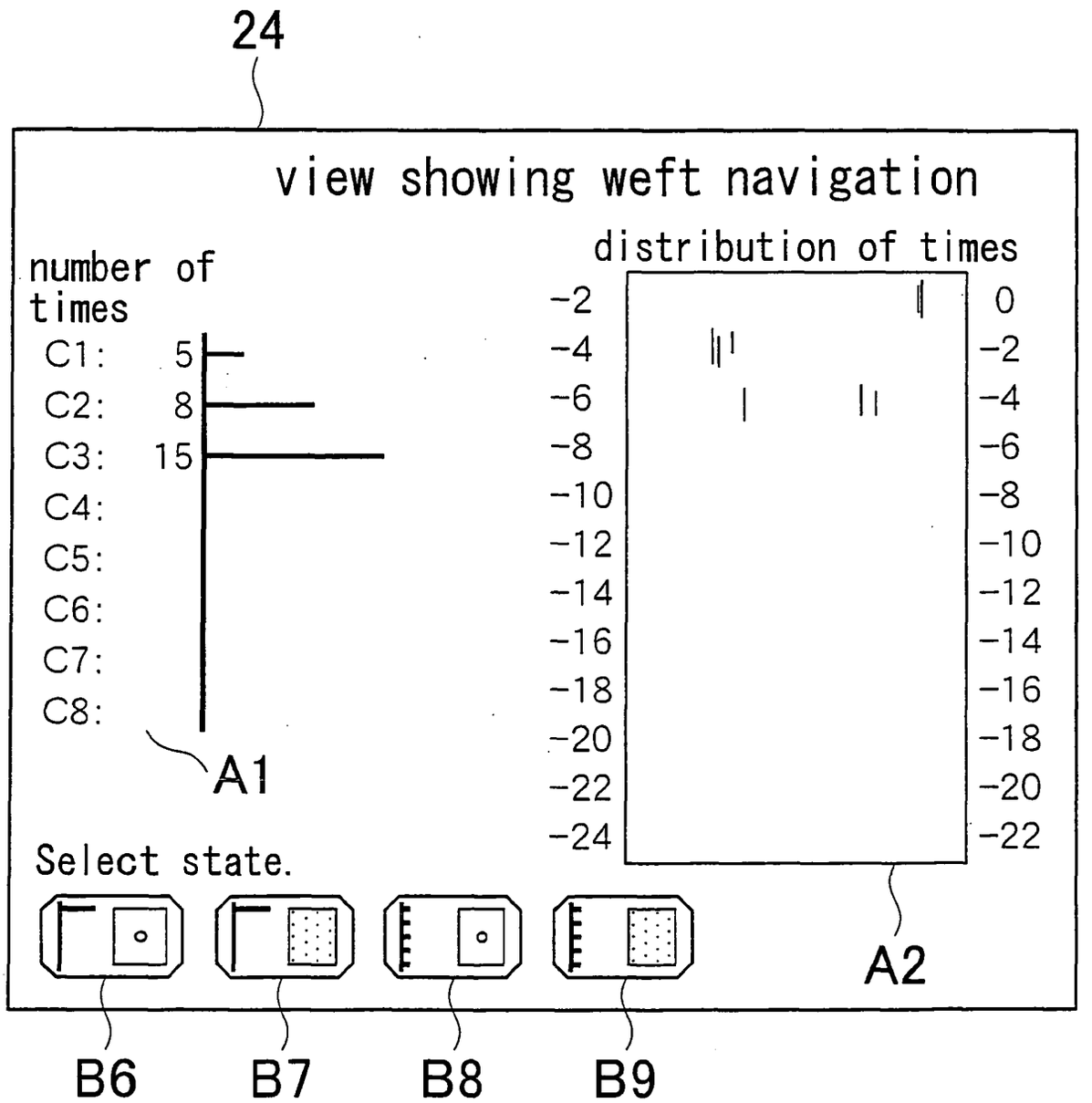

24
view showing weft navigation
number of times
C1: 5
C2: 8
C3: 15
C4:
C5:
C6:
C7:
C8:
A1
distribution of times
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
A2
Select state.
B6
B7
B8
B9

Fig. 9

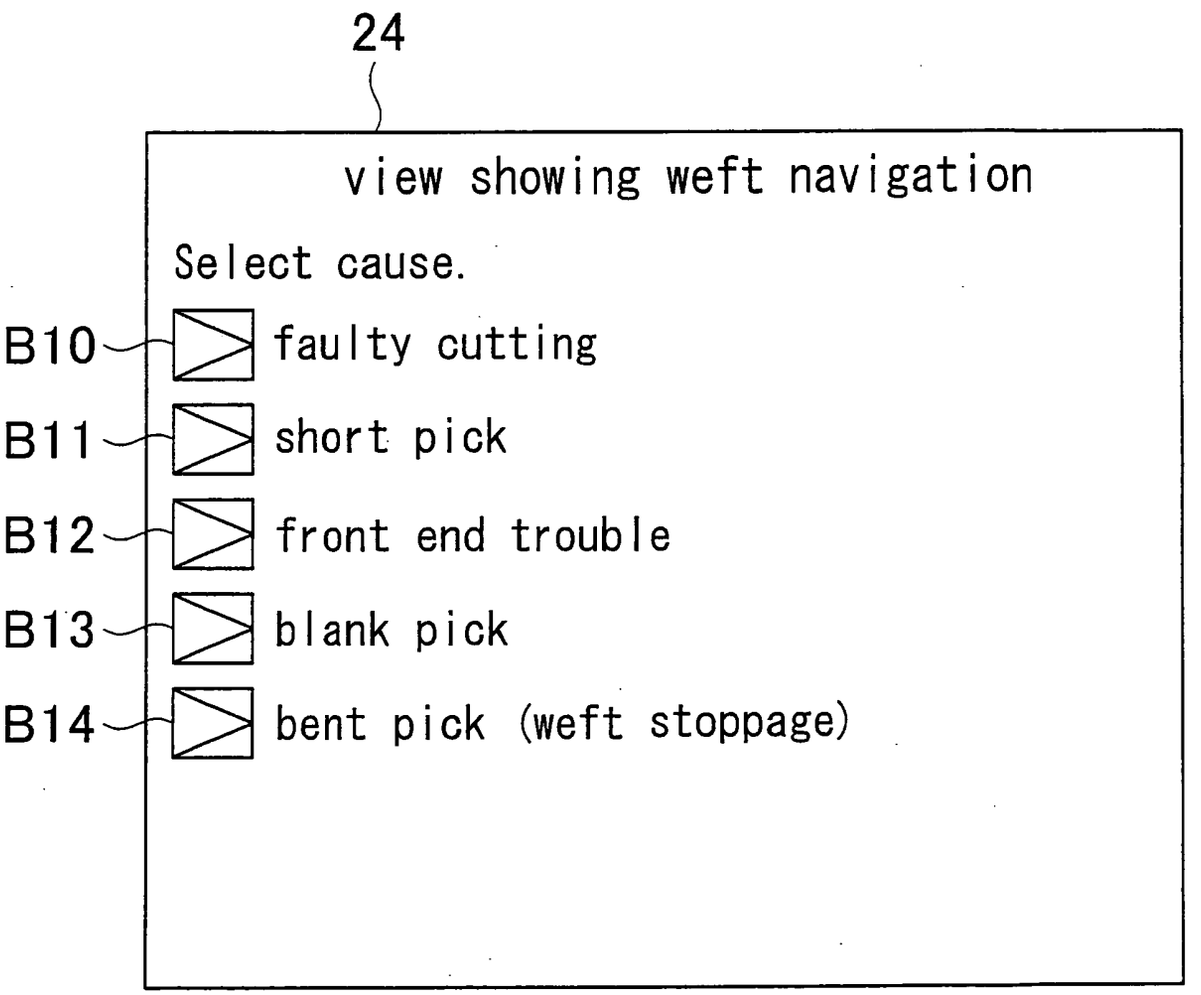

24
view showing weft navigation
Select cause.
B10
faulty cutting
B11
short pick
B12
front end trouble
B13
blank pick
B14
bent pick (weft stoppage)

Fig. 10

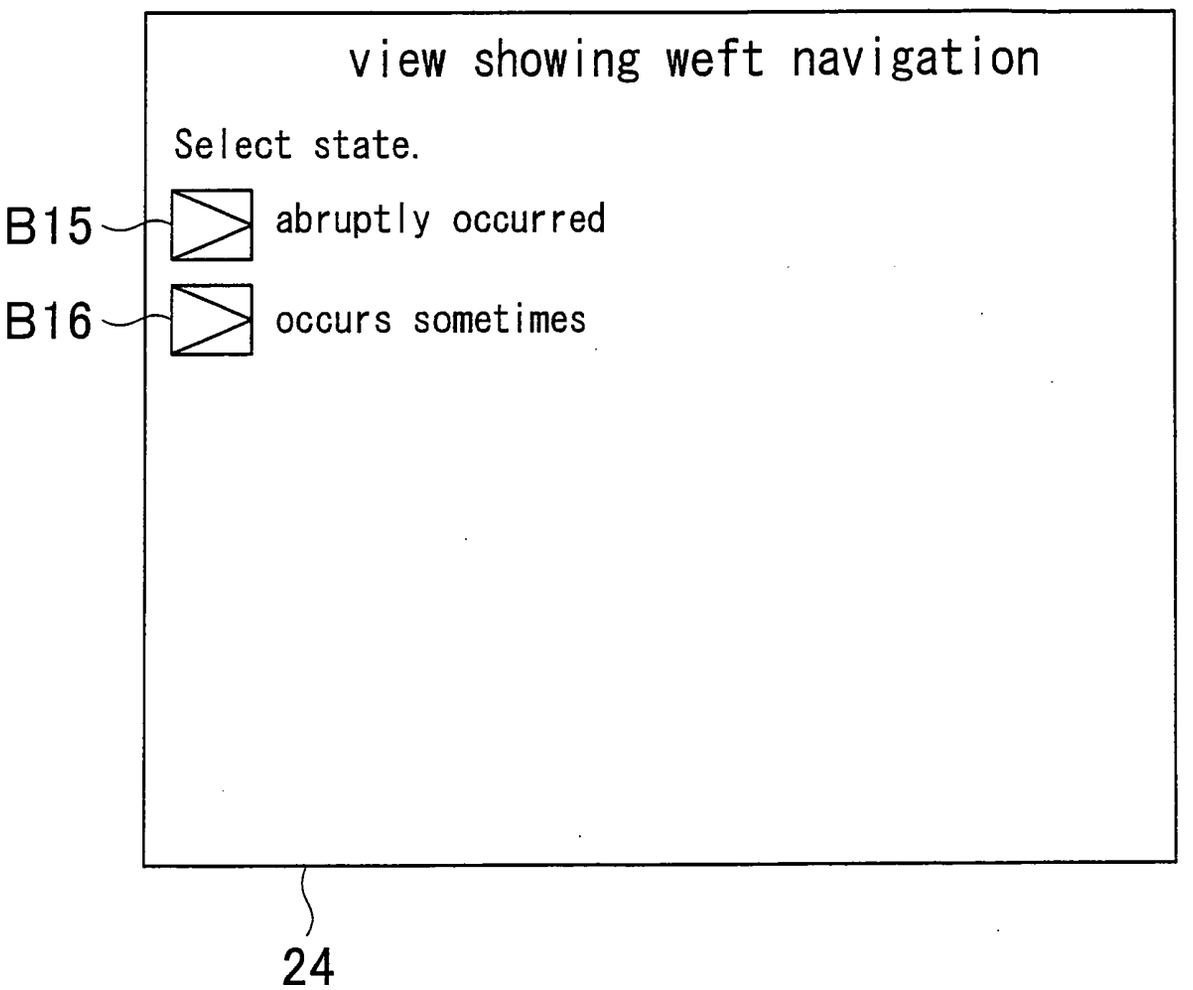

view showing weft navigation
Select state.
B15
abruptly occurred
B16
occurs sometimes
24

Fig. 11

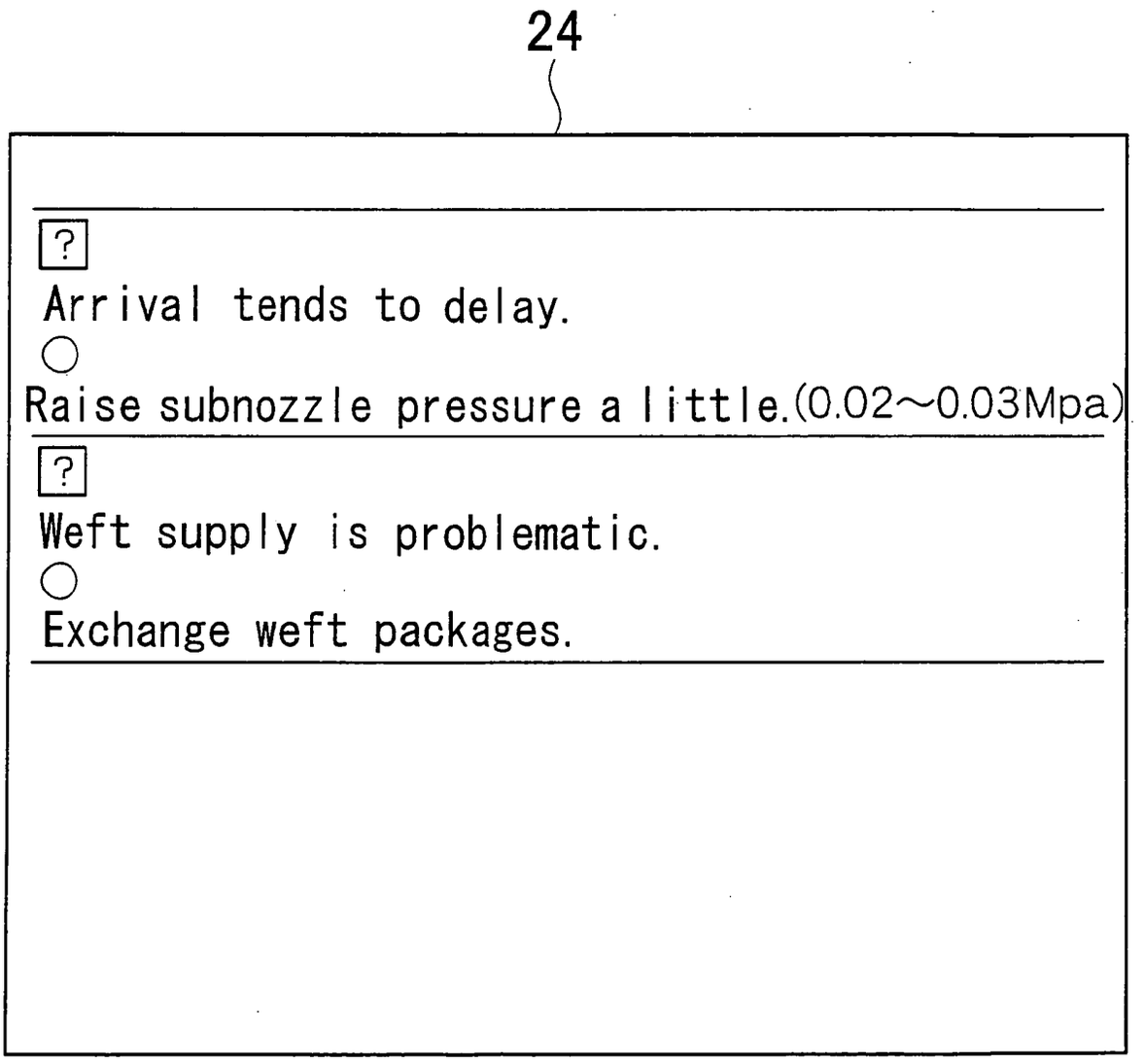

24
?
Arrival tends to delay.
Raise subnozzle pressure a little.(0.02~0.03Mpa)
?
Weft supply is problematic.
Exchange weft packages.

Fig. 12

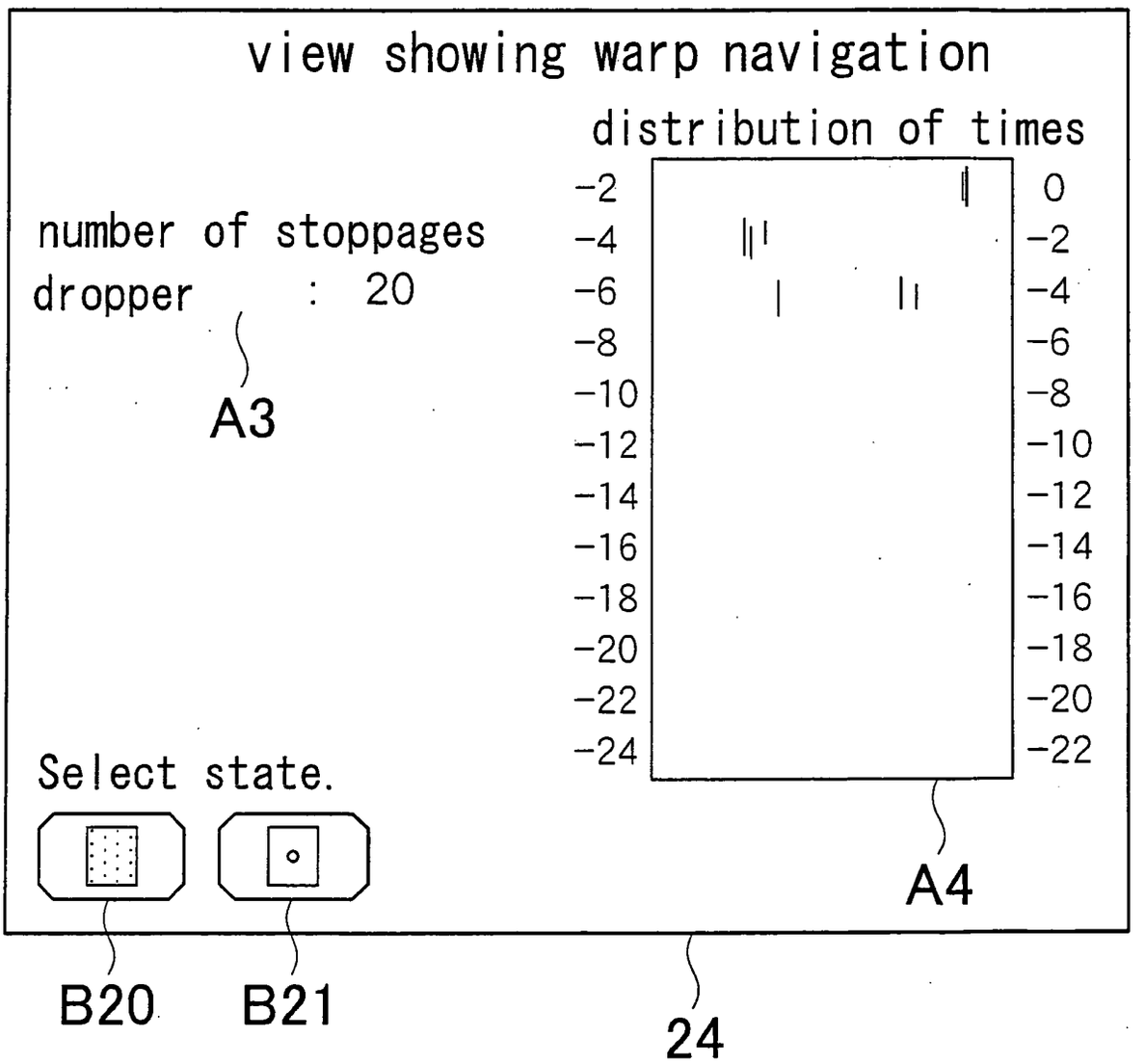

view showing warp navigation
distribution of times
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
number of stoppages
dropper : 20
A3
Select state.
A4
B20
B21
24

Fig. 13

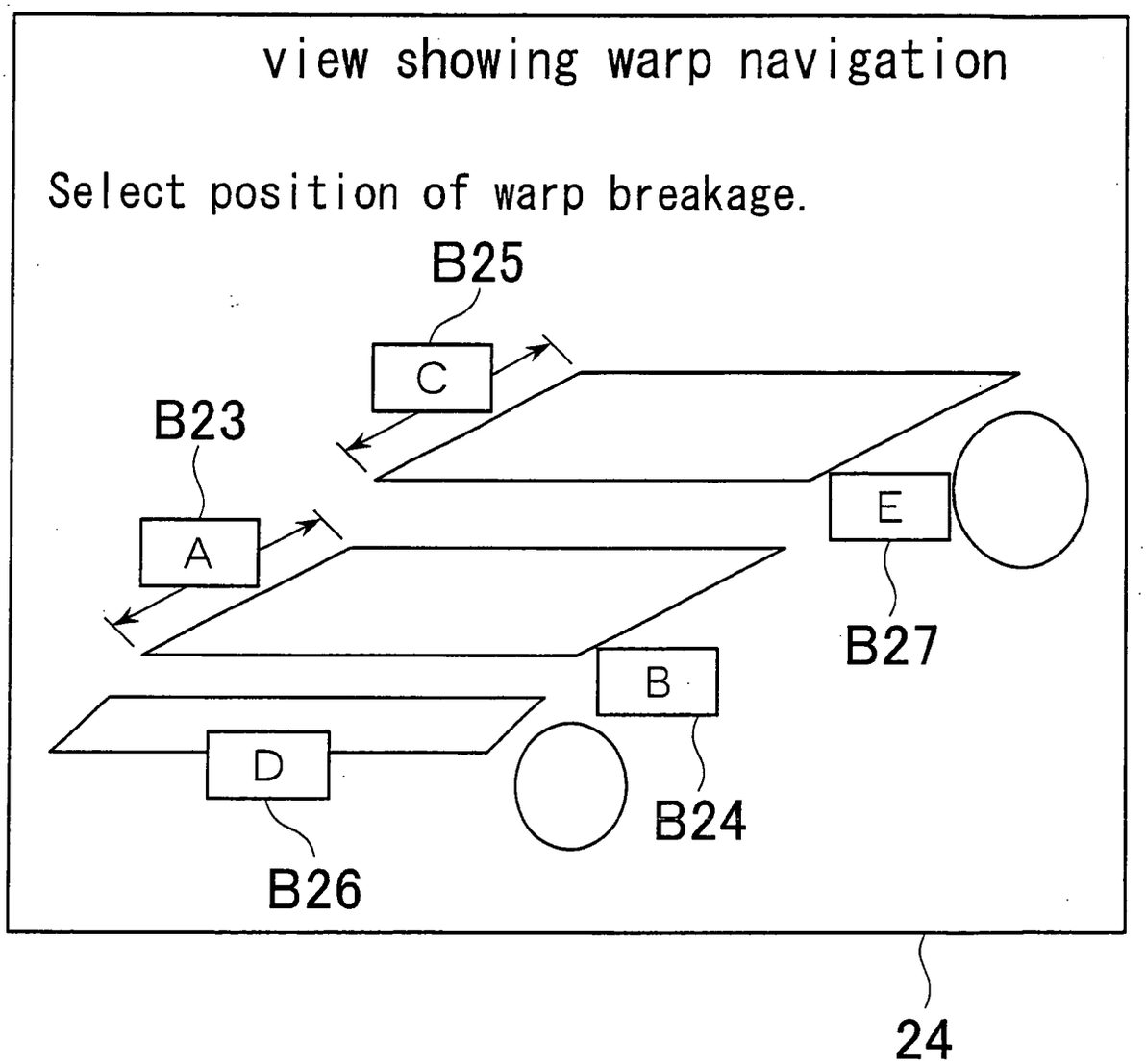

view showing warp navigation
Select position of warp breakage.
B25
C
B23
A
E
B27
B
D
B24
B26
24

Fig. 14

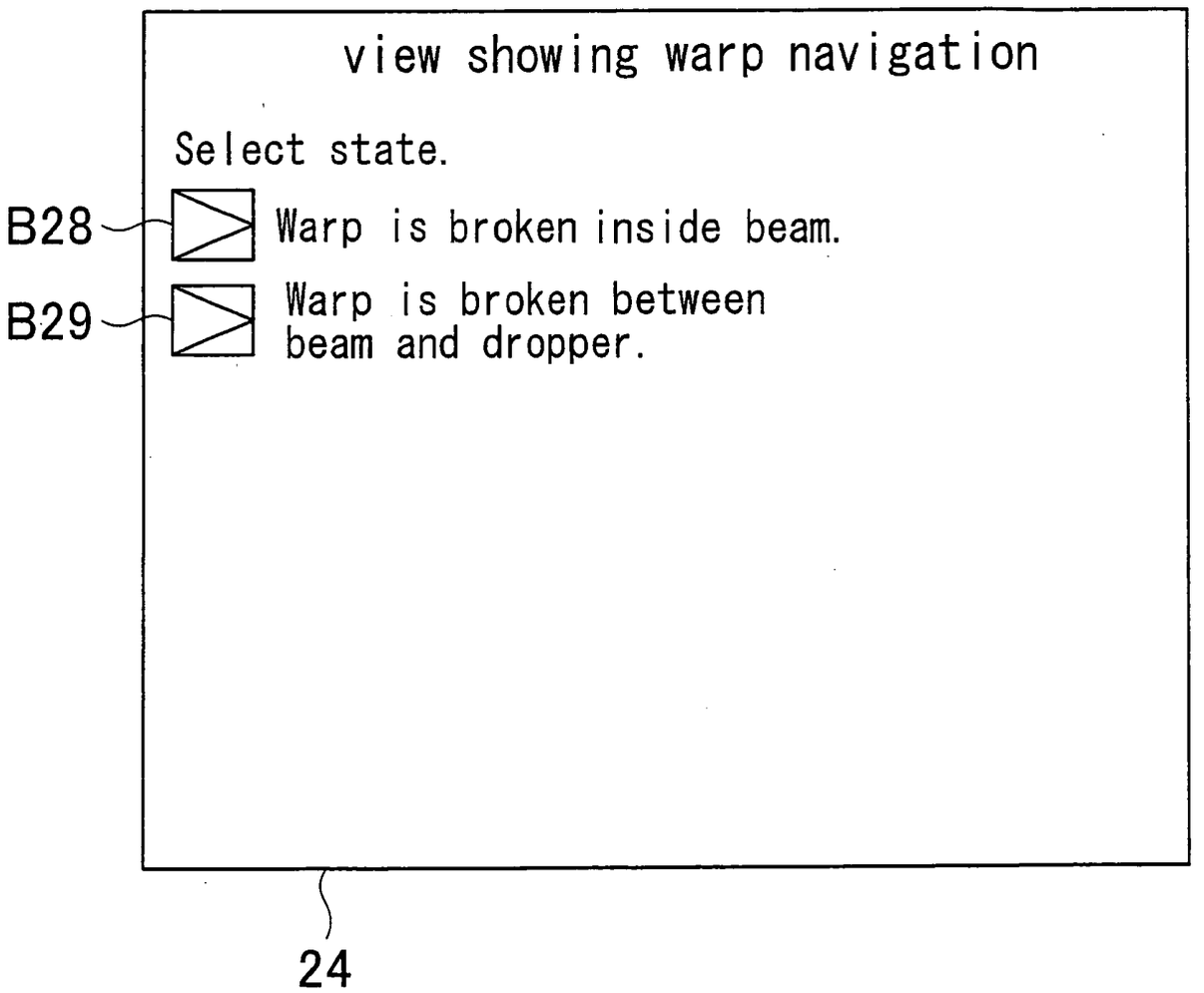
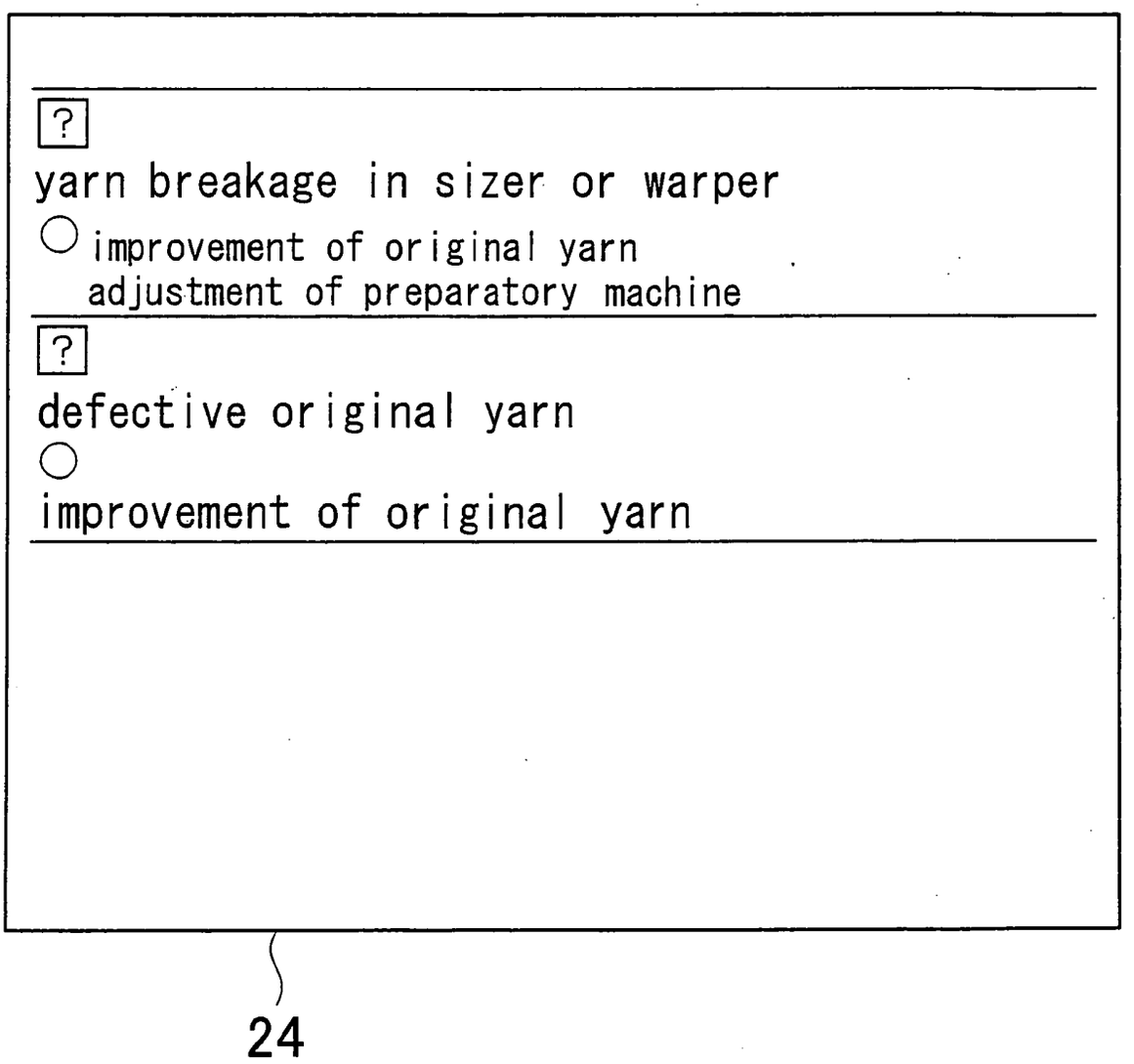

view showing warp navigation
Select state.
B28
Warp is broken inside beam.
B29
Warp is broken between beam and dropper.
24

Fig. 15


?
yarn breakage in sizer or warper
○ improvement of original yarn
adjustment of preparatory machine
?
defective original yarn
○
improvement of original yarn
24