

APPARATUS FOR REMOTELY OPERATING CRANE APPARATUS, CRANE
APPARATUS, AND SYSTEM FOR REMOTELY OPERATING CRANE APPARATUS

BACKGROUND OF THE INVENTION

5 1. FIELD OF THE INVENTION

The present invention relates to remote operation of crane apparatuses used for, for example, unloading and loading of cargo, including containers, at docks for transport of the cargo.

2. DESCRIPTION OF RELATED ART

10 In yards such as dockyards, loading and unloading is carried out with crane apparatuses, such as loading boats and ships or chassis with containers and unloading such containers from boats and ships or chassis. These types of known crane apparatus include yard cranes such as Rubber Tired Gantry Cranes
15 (RTG), which can automatically run on a road by means of rubber tires.

The method of driving this type of crane switches between manual driving and automatic driving. More specifically, in the case of a yard crane, loading onto and unloading from a chassis, serving as a container-transport truck, is carried out by manual
20 driving. Loading onto and unloading from the chassis is carried out by manual driving as described above because it is difficult to correctly align the chassis with the yard crane. Furthermore, since the chassis is driven under the supervision of a person,
25 the driver of the yard crane should preferably check that adequate

safety precautions have been taken before handling containers. Other portions of the loading and unloading operations are basically performed by automatic driving.

For example, Japanese Unexamined Patent Application
5 Publication No. 5-246683 discloses the following method. A plurality of cameras is installed on a trolley installed on a yard crane, video signals captured with these cameras are displayed on a monitor installed in a control tower by wirelessly transmitting the video signals to the control tower, and an
10 operator remotely operates the yard crane while viewing the images displayed on this monitor.

In addition, Japanese Unexamined Patent Application
Publication No. 2004-123367 discloses a technology for allowing a single operator to operate a plurality of cranes by receiving
15 video signals from the plurality of cranes and automatically switching among images displayed on a monitor according to the operational states of these cranes.

In the remote operation method disclosed in Japanese Unexamined Patent Application Publication No. 2004-123367,
20 however, video signals captured with the cameras installed on the trolleys of the cranes and command signals for operating the cranes, which are transmitted from a control tower, are individually transmitted. Furthermore, when switching to a crane to be operated, these video signals and the command signals
25 for operating the cranes are switched individually. In this case,

matching between a video signal and an operation signal may not be achievable due to logic or device incompatibility, which may cause a so-called mismatching problem whereby the crane that sends the video image displayed on the monitor differs from the
5 crane being operated by the operator.

BRIEF SUMMARY OF THE INVENTION

The present invention has been conceived to overcome the above-described problem, and it is an object of the present
10 invention to provide an apparatus for remotely operating a crane apparatus, a crane apparatus, and a system for remotely operating a crane apparatus capable of ensuring the prevention of mismatching between a yard crane that sends a video image displayed on a monitor and a yard crane to be remotely operated.

15 In order to overcome the above-described problem, the present invention employs the following solutions.

According to a first aspect of the present invention, a remote-operating apparatus for remotely operating a plurality of crane apparatuses performing loading and unloading in a
20 container yard includes a reception unit configured to receive a video signal showing loading and unloading states transmitted from the plurality of crane apparatuses; and a display unit configured to display an image based on a received video signal, wherein first identification information of the crane apparatus
25 that has sent the received video signal is displayed in part of

the image displayed by the display unit.

With this structure, a video signal showing a loading and unloading state transmitted from a crane apparatus is received by the reception unit and is displayed on the display unit as an image. In this case, since the first identification information of the crane apparatus that has sent the received video signal is displayed in part of the image displayed by the display unit, the operator can easily confirm whether the first identification information displayed on the display screen matches second identification information of the crane currently being remotely operated. As a result, mismatching between the crane apparatus that has sent the image displayed on the display screen and the crane apparatus to be remotely operated can easily be eliminated.

The above-described remote-operating apparatus preferably further includes a remote-operating unit configured to issue an operation command to one of the crane apparatuses to be operated; a comparison unit configured to compare the first identification information of the crane apparatus displayed on the display unit with the second identification information of the crane apparatus to be operated; and a report unit configured to report a result of the comparison.

Since this structure includes the comparison unit configured to compare the second identification information of the crane apparatus to which the operation command is issued from

the remote-operating unit with the first identification information of the crane apparatus displayed on the display unit, mismatching between the crane apparatus that has sent the image displayed on the display unit and the crane apparatus to be remotely operated can be detected automatically. Furthermore, the report unit configured to report a comparison result allows the operator to easily check whether mismatching has occurred. As a result, not only can the workload imposed on the operator be reduced, but also mismatching can be detected more reliably.

The above-described remote-operating apparatus preferably further includes a remote-operating unit configured to issue an operation command to one of the crane apparatuses to be operated; a comparison unit configured to compare the first identification information of the crane apparatus displayed on the display unit with second identification information of the crane apparatus to be operated; and an operation-disabling unit configured to disable a remote operation by the remote-operating unit if the first identification information does not match the second identification information as a result of the comparison.

Since this structure includes the comparison unit configured to compare the second identification information of the crane apparatus to which the operation command is issued from the remote-operating unit with the first identification information of the crane apparatus displayed on the display unit, mismatching between the crane apparatus that has sent the image

displayed on the display screen and the crane apparatus to be remotely operated can be detected automatically. Furthermore, since a remote operation by the remote-operating unit is disabled by the operation-disabling unit if the first identification
5 information does not match the second identification information as a result of the comparison, a crane different from the one displayed on the monitor is prevented from being operated.

Furthermore, the operation-disabling unit and the report unit may be combined.

10 The first identification information of the crane apparatus that has sent the received video signal is preferably superimposed on the received video signal.

Since the first identification information of the crane apparatus that has sent the received video signal is superimposed
15 on the received video signal as described above, the first identification information of the crane apparatus can easily be acquired and displayed.

The comparison unit provided in the remote-operating apparatus preferably acquires the first identification
20 information of the crane apparatus that has sent the received video signal by extracting the first identification information superimposed on the received video signal. As a result, the first identification information of the crane apparatus that has sent the video signal displayed on the display unit can be acquired
25 easily.

According to a second aspect of the present invention, a video transmission apparatus disposed in a crane apparatus remotely operated based on an operation command from a remotely provided remote-operating apparatus includes an image-acquiring unit configured to acquire an image of a loading and unloading operation; a signal processing unit configured to process and output a video signal acquired by the image-acquiring unit; and a transmission unit configured to transmit the video signal output from the signal processing unit to the remote-operating apparatus.

With this structure, an image of a loading and unloading operation is acquired by the image-acquiring unit; the video signal is processed and output by the signal processing unit; and the processed video signal is transmitted to the remote-operating apparatus by the transmission unit. As a result, the operator at the remote-operating apparatus can be quickly informed of the state of the loading and unloading operation.

According to a third aspect of the present invention, an automatic-drive control apparatus disposed in a crane apparatus remotely operated based on an operation command from a remotely provided remote-operating apparatus includes a reception unit configured to receive the operation command from the remote-operating apparatus; and a drive control unit configured to control driving based on the received operation command.

With this structure, the operation command from the

remote-operating apparatus is received by the reception unit and driving based on this received operation command is performed by the drive control unit. As a result, appropriate loading and unloading can be realized based on an appropriate operation
5 command from the remote-operating apparatus.

According to a fourth aspect of the present invention, a crane apparatus remotely operated based on an operation command from a remotely provided remote-operating apparatus includes a video transmission apparatus and an automatic-drive control
10 apparatus. The video transmission apparatus includes an image-acquiring unit configured to acquire an image of a loading and unloading operation; a signal processing unit configured to process and output a video signal acquired by the image-acquiring unit; and a transmission unit configured to transmit the video
15 signal output from the signal processing unit to the remote-operating apparatus. The automatic-drive control apparatus includes a reception unit configured to receive the operation command from the remote-operating apparatus; and a drive control unit configured to control driving based on the
20 received operation command.

With this structure, an image of a loading and unloading operation is acquired by the image-acquiring unit; the video signal is processed and output by the signal processing unit; and the processed video signal is transmitted to the
25 remote-operating apparatus by the transmission unit. As a result,

the operator at the remote-operating apparatus can be quickly informed of the state of the loading and unloading operation. On the other hand, the operation command from the remote-operating apparatus is received by the reception unit and driving based on this received operation command is performed by the drive control unit.

As a result, the operator at the remote-operating apparatus can be quickly informed of the state of the loading and unloading operation, and appropriate loading and unloading can be realized based on an appropriate operation command from the remote-operating apparatus.

According to a fifth aspect of the present invention, a system for remotely operating a crane apparatus includes a plurality of crane apparatuses performing loading and unloading in a container yard and a remote-operating apparatus for remotely operating the plurality of crane apparatuses. Each of the plurality of crane apparatuses includes an image-acquiring unit configured to acquire an image of a loading and unloading operation; a signal processing unit configured to process and output a video signal acquired by the image-acquiring unit; and a transmission unit configured to transmit the video signal output from the signal processing unit to the remote-operating apparatus; and a reception unit configured to receive an operation command from the remote-operating apparatus; and a drive control unit configured to perform driving based on the

received operation command. The remote-operating apparatus for remotely operating the plurality of crane apparatuses includes a reception unit configured to receive a video signal transmitted from the plurality of crane apparatuses; a display unit
5 configured to display an image based on a received video signal; a remote-operating unit configured to input an operation command to one of the crane apparatuses to be operated; and a transmission unit configured to transmit the operation command to the crane apparatus to be operated. Identification information of the
10 crane apparatus that has sent the received video signal is displayed in part of the image displayed by the display unit.

With this structure, an image of a loading and unloading operation is acquired by the image-acquiring unit provided in the crane apparatus, this video signal is processed by the signal
15 processing unit, and the processed video signal is transmitted to the remote-operating apparatus by the transmission unit. This video signal is received by the reception unit of the remote-operating apparatus and is then displayed as an image by the display unit. In this case, the identification information
20 of the crane apparatus that has sent the received video signal is displayed in part of the image displayed by the display unit. Therefore, the operator can input an operation command on the remote-operating unit while confirming whether the
identification information displayed on the display screen
25 matches the identification information of the crane currently

being remotely operated. In this manner, the operation command input from the remote-operating unit is transmitted to the crane apparatus to be operated by the transmission unit. This operation command is received by the reception unit of the crane apparatus, and drive control based on this operation command is performed by the drive control unit. Since the identification information of the crane apparatus that has sent the video signal is displayed on the display screen as described above, mismatching with the crane apparatus to be remotely operated can be easily eliminated.

According to the present invention, mismatching between the crane apparatus that has sent the video image displayed on the monitor and the crane apparatus to be remotely operated can be eliminated reliably.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

Fig. 1 is a schematic diagram depicting the entire concept of a yard-crane remote-operating system according to one embodiment of the present invention.

Fig. 2 is a schematic diagram depicting the entire concept of a yard-crane remote-operating system according to one embodiment of the present invention.

Fig. 3 is a perspective view of a yard crane according to one embodiment of the present invention.

Fig. 4A is a front elevational view of a yard crane according

to one embodiment in the present invention.

Fig. 4B is a plan view of a yard crane according to one embodiment in the present invention.

Fig. 5 is a diagram depicting one exemplary arrangement
5 of a control console and television monitors of a remote-operating apparatus according to one embodiment of the present invention.

Fig. 6 is a front elevational view of one exemplary arrangement of television monitors.

10 Fig. 7 is a diagram depicting one example of images displayed on the display screen of a television monitor.

Fig. 8 is a diagram depicting one example of an image displayed on the display screen of a television monitor.

15 DETAILED DESCRIPTION OF THE INVENTION

One embodiment according to the present invention will now be described with reference to the drawings. In this embodiment, a crane apparatus will be described by way of example of a yard crane.

20 Figs. 1 and 2 are schematic diagrams depicting the entire concept of a yard-crane remote-operating system according to one embodiment of the present invention. Referring to Fig. 1, a yard-crane remote-operating system 1 includes a plurality of yard cranes 10 and a plurality of yard-crane remote-operating
25 apparatuses (hereinafter, referred to as the "remote-operating

apparatuses") 40.

The plurality of yard cranes 10 are arranged on a plurality of lanes provided in a yard so that they run in the same directions, and each of these yard cranes 10 is provided with a unique
5 identification number. Referring to Fig. 2, each yard crane 10 is provided with a video transmission apparatus 20 and an automatic-drive control apparatus 30. The video transmission apparatus 20 includes a plurality of cameras (image-acquiring units) 21 to 24; a video-transmission switching apparatus 25 for
10 switching between video signals acquired by the plurality of cameras 21 to 24 according to an output screen selection signal sent from one of the remote-operating apparatuses 40 (described later); a signal processing section (signal processing unit) 26 for applying predetermined signal processing to a predetermined
15 video signal selected by the video-transmission switching apparatus 25; and a transmission section (transmission unit) 27 for transmitting to the remote-operating apparatus 40 the video signal processed by the signal processing section 26. The automatic-drive control apparatus (drive control apparatus) 30
20 receives an operation command transmitted from the remote-operating apparatus 40. The automatic-drive control apparatus 30 includes a transmission and reception section (reception unit) 31 for transmitting, for example, the identification number thereof to the remote-operating apparatus
25 40 and a drive control section (drive control unit) 32 for

controlling the driving of the yard crane 10 based on the operation command received by the transmission and reception section 31.

The signal processing section 26 includes a plurality of four-screen combiners 261 configured to combine and output video signals output from the video-transmission switching apparatus 25; a plurality of modulators 262 for modulating and outputting video signals from the four-screen combiners 261; and a mixer 263 for mixing the signals from the modulators 262 and converting the signals into a format appropriate for transmission. The four-screen combiners 261 in this signal processing section 26 have a superimposing function for superimposing the identification information of the yard crane onto the video signals from the video-transmission switching apparatus 25. With this function, when a video signal is displayed, the identification number of the yard crane is displayed in part of the display image.

Referring to Fig. 3, each yard crane 10 includes a plurality of legs 12 supported on the ground of the yard via a plurality of travel wheels 11 and beams 13 bridged between the legs 12 to form gantry structures with the legs 12 and the beams 13. The yard crane 10 further includes a trolley 14 provided on the beams 13 so as to be movable in the axial directions of the beams 13 and a load block 15 suspended from the trolley 14.

In this yard crane 10, the above-described cameras 21 to 24 are installed at, for example, the following locations.

Referring to Fig. 4A, the camera 21 is provided on the trolley 14 so as to capture an image of the head of a container 90 or 91 located therebelow. This camera 21 is arranged so that the number written on top of the container 90 or 91 can be visually confirmed before the container 90 or 91 is handled. Furthermore, this camera 21 has a swivel mechanism and a zoom mechanism so that the conditions in the lane of the crane can be confirmed in the event of an abnormality.

Two cameras 22 are provided on the load block 15 so as to capture the images of corners 90b of the container 90 located therebelow. These cameras 22 are arranged so that the stacked state of the stored container 90 can be confirmed when the load block 15 is lowered. Furthermore, the cameras 22 are so arranged that the relative position between the container 90 until just before the container 90 lands and the transverse direction of the container 90 can be confirmed when the container 90 is to be handled.

One of the legs 12 is provided with two cameras 23 to capture an image of the entire body of a chassis 80 that approaches and stops by the side thereof. These cameras 23 are arranged so that the position of the entire container 91 can be confirmed until just before the container 91 is placed onto the chassis 80 when the container 91 is to be loaded on the chassis 80.

Referring to Fig. 4B, four cameras 24 are provided so as to capture images in the travel direction of yard crane 10. These

cameras 24 are provided to ensure safety in the forward and backward directions, respectively, of the travel route when the yard crane 10 is to travel.

Referring back to Fig. 2, each remote-operating apparatus 5 40 includes a reception section (reception unit) 41; a video-reception switching apparatus 42; television monitors (display units) 43; a control console (remote-operating unit) 44; a data processing terminal device 45; and a transmission and reception section 46. The reception section 41 includes a 10 leakage coaxial cable 61 installed, for example, in the crane yard. The video-reception switching apparatus 42 is connected to the reception section 41 so that video images captured by the cameras 21 to 24 can be received and is also connected to the monitors 43 so that the received video images can be displayed.

15 The television monitors 43 and the control console 44 are arranged, for example, as shown in Fig. 5. The control console 44 is provided with levers 51 having a function for operating the yard crane 10, as well as the trolley 14 and the load block 15 provided in the yard crane 10. These levers 51 are arranged 20 in front of a driver seat 52 so that the operator can operate them while sitting in the driver seat 52.

The monitors 43 include six monitors 43a to 43f arranged so that the operator can easily see the screens thereof from the control console 44. The monitors 43a and 43b display video images 25 of the operated portions of the yard crane 10 as captured by the

cameras 21 to 24, for example, as shown in Fig. 6. Furthermore, the monitor 43c displays, for example, a simulated diagram of the yard crane 10 or moving images of the real-time operation of the yard crane 10.

5 The monitor 43d displays, for example, a simulated diagram of the yard where the yard crane 10 is disposed or moving images showing the real-time movement of the yard crane 10. The monitor 43e displays, for example, instruction data for controlling the subsequent operation of the yard crane 10. The monitor 43f
10 displays, for example, a program controlling the operation of the yard crane 10. In addition, the monitor 43c is provided with a report section 100 for informing the operator of a comparison result obtained by a comparison section 74 included in the data processing terminal device 45 (described later).

15 The data processing terminal device 45 is connected to the television monitors 43, the control console 44, and the transmission and reception section 46. The data processing terminal device 45 includes a video-capture board 71 which receives a video signal from the monitors 43a and 43b and an
20 optical character recognition (OCR) unit 72 which reads out identification information from a video image acquired by the video-capture board 71. The data processing terminal device 45 also includes a wireless-communication data processing section 73 which acquires the identification information of the yard
25 crane 10 remotely operated by the control console 44. The data

processing terminal device 45 further includes the comparison section (comparison unit) 74 for comparing the identification number read out by the OCR unit 72 with the identification number acquired by the wireless-communication data processing section 5 73 to determine whether both the identification numbers match. The report section (report unit) 100 (as shown in Fig. 5 and Fig. 6) for informing the operator of the comparison result and an operation-disabling section (operation-disabling unit, not shown in the figure) which disables the operation of the control 10 console 44 are connected to the comparison section 74.

The video-reception switching apparatus 42 and the control console 44 are connected via a high-level personal computer (PC) 80. The high-level PC 80 manages the handling of all yard cranes 10 in the yard, instructs the data processing terminal device 15 45 to connect to the yard crane 10 to be remotely driven, and outputs a video-switching signal to the video-reception switching apparatus 42 based on the content of this instruction. As a result, a video signal of the yard crane 10 to be operated is selected by the video-reception switching apparatus 42, and 20 an image based on this video signal is output to the television monitors 43.

In the above-described system structure, the transmission and reception section 31 installed in the yard crane 10 and the transmission and reception section 46 provided in the 25 remote-operating apparatus 40 are wireless modems which realize

transmission and reception with each other through wireless communication. Wireless data communication by the use of these modems enables transmission and reception of an operation command to and from a yard crane 10. In addition, the transmission
5 section 27 of the video transmission apparatus 20 provided in the yard crane 10 enables transmission and reception of video and audio data to and from the remote-operating apparatus 40 by the use of radio waves leaking from the leakage coaxial cable 61 routed in the container yard. As described above, in the
10 yard-crane remote-operating system according to this embodiment, the transmission path of video signals differs from the transmission and reception path of operation commands to the yard crane 10.

The operation of the yard-crane remote-operating system
15 1 with the above-described structure will now be described.

When one of the yard cranes 10 is to be remotely operated by the remote-operating apparatus 40, only a predetermined video signal is selected by the video-transmission switching apparatus
25 from among video signals acquired by the cameras 21 to 24 installed in the yard crane 10 and is then supplied to the signal processing apparatus 26. The signal processing apparatus 26 superimposes the identification number of that yard crane 10 on the supplied video signal and outputs it to the transmission
section 27. The video signal having the identification number
25 of this yard crane 10 superimposed thereon is transmitted to the

remote-operating apparatus 40 via the transmission section 27.

This video signal is received by the leakage coaxial cable 61 routed in the container yard and is then supplied to a photoconversion amplifier 62. The electrical signal is converted into an optical signal in the photoconversion amplifier 62 and is then supplied to the video-reception switching apparatus 42 via an optical cable and a plurality of O/E converters 63. In the video-reception switching apparatus 42, a predetermined video signal is selected based on a video-signal switching signal from the high-level PC 80 and is then supplied to the television monitors 43 via a signal splitter. The television monitors 43 display the supplied video signal thereon as images. At this time, since the identification number of the yard crane 10 is superimposed on the video signal, the identification number of the yard crane 10 is indicated in part of the images displayed on the television monitors 43, as shown in Fig. 7 and Fig. 8.

While confirming the images displayed on these television monitors 43, the operator seated in front of the control console 44 inputs an operation command by operating, for example, a lever 51 provided on the control console 44. This operation command is supplied to the wireless-communication data processing section 73 in the data processing terminal device 45. The data processing terminal device 45 acquires the identification information of the yard crane 10 to which this operation command

is transmitted and outputs this identification information to the comparison section 74.

On the other hand, the video signal currently displayed on the television monitors 43 is supplied to the video-capture board 71 in the data processing terminal device 45. The
5 identification information of the yard crane 10 superimposed on this video signal is extracted by the video-capture board 71 and the OCR unit 72 and is then supplied to the comparison section 74. In the comparison section 74, the identification information
10 of the yard crane 10 input from the wireless-communication data processing section 73 is compared with the identification information of the yard crane 10 input from the OCR unit 72. It is then determined whether both the identification numbers match, and the determination result is output to the report section 100
15 (refer to Fig. 5) and the operation-disabling section (not shown in the figure).

If both the identification numbers match, the operator is informed, by the report section 100, that the operation is normal. Furthermore, an operation command input on the control console
20 44 is sent to a communication server and the transmission and reception section 46 via the wireless-communication data processing section 73 and is then transmitted from the transmission and reception section 46 to the yard crane 10. As a result, the operation command is received by the transmission
25 and reception section 31 of the automatic-drive control apparatus

30 provided in the yard crane 10 and is then supplied to the drive control section 32 so that driving is carried out based on this operation command. Subsequently, transmission and reception of the video signal and the operation command are carried out between
5 the yard crane 10 and the remote-operating apparatus 40 to achieve remote operation of the yard crane 10. While this remote operation is in progress, comparison of identification information by the comparison section 74 continues. If it is determined that both identification numbers do not match as a
10 result of this comparison, the operator is informed that the identification numbers do not match via the report section 100, and furthermore, the operation command input from the control console 44 is disabled by the operation-disabling section to stop transmission of operation commands to the yard crane 10. In this
15 case, remote operation is suspended until the cause of the mismatch is identified, and then normal operation is restored.

As described above, according to the remote operation system of this embodiment, a video signal showing the loading and unloading state, which is transmitted from the yard crane
20 10, is received by the reception section 41 of the remote-operating apparatus 40 and is displayed on the television monitors 43 as images. In this case, since the identification information of the yard crane 10 which has sent that video signal is shown in part of the images displayed on the television monitors
25 43, as shown in Fig. 7 and Fig. 8, the operator can easily confirm

whether the identification information displayed on the display screen matches the identification information of the crane currently being remotely operated. As a result, mismatching between the yard crane which has sent the image displayed on the display screen and the yard crane to be remotely operated can be easily avoided.

Furthermore, in this embodiment, since the comparison section 74 for comparing the identification information of the yard crane 10 displayed on the television monitors 43 with the identification information of the yard crane to be remotely operated by the operator is provided, mismatching between the yard crane which has sent a video signal and the yard crane to which an operation command is to be sent can be automatically detected. As a result, not only can the workload of the operator be reduced, but also mismatching can be detected more reliably. Furthermore, by providing the report section 100 for notifying the operator of any detected mismatching, the operator can be quickly informed of the fact that mismatching has occurred. In addition, since the operation-disabling section is provided for automatically disabling an operation command if mismatching occurs, a yard crane different from the one displayed on the television monitors 43 can be prevented from being remotely operated.

What is claimed is:

1. A remote-operating apparatus for remotely operating a plurality of crane apparatuses performing loading and unloading in a container yard, comprising:

a reception unit configured to receive a video signal showing loading and unloading states transmitted from the plurality of crane apparatuses; and

a display unit configured to display an image based on a received video signal,

wherein first identification information of the crane apparatus that sends the received video signal is displayed in part of the image displayed by the display unit.

2. The remote-operating apparatus according to claim 1, further comprising:

a remote-operating unit configured to issue an operation command to one of the crane apparatuses to be operated;

a comparison unit configured to compare the first identification information of the crane apparatus displayed on the display unit with second identification information of the crane apparatus to be operated; and

a report unit configured to report a result of the comparison.

3. The remote-operating apparatus according to claim 1, further comprising:

a remote-operating unit configured to issue an operation command to one of the crane apparatuses to be operated;

5 a comparison unit configured to compare the first identification information of the crane apparatus displayed on the display unit with second identification information of the crane apparatus to be operated; and

10 an operation-disabling unit configured to disable a remote operation by the remote-operating unit if the first identification information does not match the second identification information as a result of the comparison.

4. The remote-operating apparatus according to one of claims 15 1 to 3, wherein the first identification information of the crane apparatus that sends the received video signal is superimposed on the received video signal.

5. The remote-operating apparatus according to claim 4, wherein 20 the comparison unit acquires the first identification information of the crane apparatus that sends the received video signal by extracting the first identification information superimposed on the received video signal.

25 6. A video transmission apparatus disposed in a crane apparatus

remotely operated based on an operation command from a remotely provided remote-operating apparatus, comprising:

an image-acquiring unit configured to acquire an image of a loading and unloading operation;

5 a signal processing unit configured to process and output a video signal acquired by the image-acquiring unit; and

a transmission unit configured to transmit the video signal output from the signal processing unit to the remote-operating apparatus.

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7. An automatic-drive control apparatus disposed in a crane apparatus remotely operated based on an operation command from a remotely provided remote-operating apparatus, comprising:

15 a reception unit configured to receive the operation command from the remote-operating apparatus; and

a drive control unit configured to control driving based on the received operation command.

8. A crane apparatus remotely operated based on an operation command from a remotely provided remote-operating apparatus, comprising:

20 a video transmission apparatus including

an image-acquiring unit configured to acquire an image of a loading and unloading operation;

25 a signal processing unit configured to process and

output a video signal acquired by the image-acquiring unit; and
a transmission unit configured to transmit the video
signal output from the signal processing unit to the
remote-operating apparatus; and

5 an automatic-drive control apparatus including:

a reception unit configured to receive the operation
command from the remote-operating apparatus; and

a drive control unit configured to control driving
based on the received operation command.

10

9. A system for remotely operating a crane apparatus,
comprising:

a plurality of crane apparatuses performing loading and
unloading in a container yard; and

15 a remote-operating apparatus for remotely operating the
plurality of crane apparatuses,

wherein each of the plurality of crane apparatuses
includes:

20 an image-acquiring unit configured to acquire an image of
a loading and unloading operation;

a signal processing unit configured to process and output
a video signal acquired by the image-acquiring unit;

a transmission unit configured to transmit the video signal
output from the signal processing unit to the remote-operating
25 apparatus;

a reception unit configured to receive an operation command from the remote-operating apparatus; and

a drive control unit configured to perform driving based on the received operation command, and

5 the remote-operating apparatus includes:

a reception unit configured to receive a video signal transmitted from the plurality of crane apparatuses;

a display unit configured to display an image based on a received video signal;

10 a remote-operating unit configured to input an operation command to one of the crane apparatuses to be operated; and

a transmission unit configured to transmit the operation command to the crane apparatus to be operated, wherein identification information of the crane apparatus that sends the
15 received video signal is displayed in part of the image displayed by the display unit.