

OPTICAL TRANSMISSION DEVICE AND OPTICAL OUTPUT CONTROL SYSTEM THEREOF

Background of the Invention:

The present invention relates to an optical transmission device for carrying out a waveform-multiplexing transmission and to an optical output control system thereof

Such an optical transmission device includes a transmission device section in which light signals entered from the outside are optical/electrical converted and subjected to a necessary transmission-side signal processing such as rate conversion and the like, subsequently electric/optical converted and emitted as light signals on the transmission side and in which functions/operations opposite to those of the transmission side are performed on a reception side.

Referring to Figs. 1A and 1B, description will be made as an optical transmission device using a conventional wavelength multiplexing technique. The optical transmission device comprises a plurality of transmission device sections 40-1 to 40-n and an optical synthesis branching section 50 connected to the transmission device sections 40-1 to 40-n.

Each of the transmission device sections 40-1 to 40-n comprises an optical/electric conversion circuit 401 for converting an A kbit/s light signal entered from the outside of the device to an electric signal, a transmission-side signal processing circuit 402 for performing a rate conversion or another signal processing required for the transmission side of the A kbit/s electric signal emitted



from the optical/electric conversion circuit 401 to output a B kbit/s electric signal, an electric/optical conversion circuit 403 for converting the B kbit/s electric signal emitted from the transmission-side signal processing circuit 402 to a light signal to output the light signal to the optical synthesis branching section 50, an optical/electric conversion circuit 404 for converting a B kbit/s light signal entered from the optical synthesis branching section 50 to an electric signal, a reception-side signal processing circuit 405 for performing a rate conversion or another signal processing required for a reception side of the B kbit/s electric signal emitted from the optical/electric conversion circuit 404 to output an A kbit/s electric signal, and an electric/optical conversion circuit 406 for converting the A kbit/s electric signal emitted from the reception-side signal processing circuit 405 to a light signal to output the light signal to the outside of the device.

The optical synthesis branching section 50 comprises an optical synthesis circuit 501 for wavelength-multiplexing the B kbit/s light signals of wavelengths λ_1 to λ_n from the transmission device sections 40-1 to 40-n to output a wavelength-multiplexed light signal, an optical booster amplifier 502 for amplifying the wavelength-multiplexed light signal emitted from the optical synthesis circuit 501 to a predetermined level to transmit an output to an opposite-side optical transmission device via a transmission path; an optical preamplifier 503 for amplifying the wavelength-multiplexed light signal entered from the opposite-side optical transmission device through the transmission path to a predetermined level, and an optical branching circuit 504



for distributing/equalizing the wavelength-multiplexed light signal amplified/emitted by the optical preamplifier 503 for each wavelength and subsequently branching the light signals into the wavelengths λ_1 to λ_n to transmit outputs to the optical/electric conversion circuits 404 of the transmission device sections 40-1 to 40-n.

For the first problem in the conventional optical transmission device, in a case where the optical synthesis circuit 501 is constituted of a photocoupler or the like, for example, the electric/optical conversion circuit 403 of the wavelength λ_1 of the transmission device section 40-1 is to be replaced with a spare electric/optical conversion circuit of the same wavelength λ_1 because of failure, but a spare electric/optical conversion circuit of the wavelength λ_n for the transmission device section 40-n is actually mounted by mistake. In this case, since a light signal of the same wavelength λ_n as that of a signal emitted from the transmission device section 40-n during normal operation is emitted from the transmission device section 40-1 and two light signals of the wavelength λ_n are entered into the optical synthesis circuit 501, the system being originally operated with the wavelength λ_n causes service disconnection.

To prevent the problem, n-optical filters for passing only the predetermined wavelength may be inserted corresponding to the transmission device sections 40-1 to 40-n on the input side of the optical synthesis circuit 501 of the optical synthesis branching section 50, but the optical synthesis branching section 50 disadvantageously becomes expensive and large-scaled accordingly.



Moreover, for the second problem in the conventional optical transmission device, for example, the optical/electric conversion circuit 404 of the wavelength λ_1 of the transmission device section 40-1 is to be replaced with a spare optical/electric conversion circuit of the same wavelength λ_1 because of failure, but a spare optical/electric conversion circuit of the wavelength λ_n for the transmission device section 40-n is actually mounted by mistake. In this case, the characteristic of the optical filter depends on the wavelength λ_n mounted in the optical/electric conversion circuit 404, but an alarm of input signal disconnection or error ratio deterioration is generated. Therefore, it takes time to clear up the cause of the alarm, and, as a result, service disconnection time is lengthened until the cause is clarified.

Summary of the Invention:

It is therefore an object of the present invention to provide an optical transmission device which is capable of preventing a system being operated from being service-disconnected even when the electric/optical conversion circuit is replaced with another electric/optical conversion circuit for another transmission device section being operated.

It is another object of the present invention to provide an optical output control system of the type described, in which a cause of service disconnection can be quickly clarified to reduce a service disconnection time when the optical/electric conversion circuit is replaced with the other optical/electric conversion circuit for the other



transmission device section being operated.

It is still another object of the present invention to provide an optical output control system of the optical transmission device of the type described.

Other objects of the present invention will become clear as the description proceeds.

According to a first aspect of the present invention, there is provided an optical transmission device which comprises a plurality of transmission device sections each including transmission-side optical/electric conversion means for converting a first signal-rate light signal entered from the outside of the device to an electric signal to output a first signal-rate electric signal, transmission-side signal processing means for performing a predetermined signal processing necessary for a transmission side of the first signal-rate electric signal emitted from the transmission-side optical/electric conversion means to output a second signal-rate electric signal, transmission-side electric/optical conversion means for converting the second signal-rate electric signal emitted from the transmission-side signal processing means to a second signal-rate light signal to transmit an output to in-device another first means, reception-side optical/electric conversion means for converting the second signal-rate light signal entered from the in-device another first means to an electric signal, received signal processing means for performing rate conversion or another signal processing necessary for a reception side of the second signal-rate electric signal emitted from the reception-side optical/electric conversion means to output the first signal-rate electric signal, and



reception-side electric/optical conversion means for converting the first signal-rate electric signal emitted from the received signal processing means to a light signal to transmit the first signal-rate light signal to the outside of the device, and which comprises an optical synthesis branching section as the in-device first means including optical synthesis means for wavelength-multiplexing a plurality of light signals of different wavelengths emitted from the transmission-side electric/optical conversion means of the plurality of transmission device sections to output a wavelength-multiplexed light signal, an optical booster amplifier for amplifying the wavelength-multiplexed light signal emitted from the optical synthesis means to a predetermined level to transmit an output to an opposite-side optical transmission device via a light transmission path, an optical preamplifier for amplifying the wavelength-multiplexed light signal entered from the opposite-side optical transmission device via the light transmission path to a predetermined level, and optical branching means for distributing/equalizing and branching the wavelength-multiplexed light signal emitted from the optical preamplifier to the wavelengths to transmit outputs to the reception-side optical/electric conversion means of the plurality of transmission device sections, the optical transmission device performing wavelength-multiplexing transmission of the light signals of a plurality of wavelengths using the same optical fiber, each of the plurality of transmission device sections including transmission-side wavelength information output means for outputting wavelength information which has a one-to-one



correspondence with the wavelength of the second signal-rate light signal emitted from the transmission-side electric/optical conversion means as first wavelength information; and first transmission-side wavelength monitoring comparison means for prestoring wavelength information of the second signal-rate light signal to be handled by the transmission-side electric/optical conversion means as second wavelength information, monitoring and comparing in conformity the first wavelength information of the transmission-side wavelength information output means with the second wavelength information and for outputting a transmission output control signal in accordance with a comparison result, the transmission-side electric/optical conversion means performing output control of the second signal-rate light signal converted/emitted by itself in response to the transmission output control signal entered from the first transmission-side wavelength monitoring comparison means.

According to a second aspect of the present invention, there is provided an optical transmission device which comprises a plurality of transmission device sections each including transmission-side optical/electric conversion means for converting a first signal-rate light signal entered from the outside of the device to an electric signal to output a first signal-rate electric signal, transmission-side signal processing means for performing a predetermined signal processing necessary for a transmission side of the first signal-rate electric signal emitted from the transmission-side optical/electric conversion means to output a second signal-rate electric signal, transmission-side electric/optical conversion means for converting the second signal-

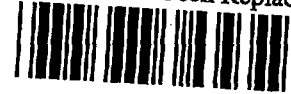


rate electric signal emitted from the transmission-side signal processing means to a second signal-rate light signal to transmit an output to in-device another first means, reception-side optical/electric conversion means for converting the second signal-rate light signal entered from the in-device another first means to an electric signal, received signal processing means for performing rate conversion or another signal processing necessary for a reception side of the second signal-rate electric signal emitted from the reception-side optical/electric conversion means to output the first signal-rate electric signal, and reception-side electric/optical conversion means for converting the first signal-rate electric signal emitted from the received signal processing means to a light signal to transmit the first signal-rate light signal to the outside of the device, and which comprises an optical synthesis branching section as the in-device first means including optical synthesis means for wavelength-multiplexing a plurality of light signals of different wavelengths emitted from the transmission-side electric/optical conversion means of the plurality of transmission device sections to output a wavelength-multiplexed light signal, an optical booster amplifier for amplifying the wavelength-multiplexed light signal emitted from the optical synthesis means to a predetermined level to transmit an output to an opposite-side optical transmission device via a light transmission path, an optical preamplifier for amplifying the wavelength-multiplexed light signal entered from the opposite-side optical transmission device through the light transmission path to a predetermined level, and optical branching means



for distributing/equalizing and branching the wavelength-multiplexed light signal emitted from the optical preamplifier to the wavelengths to transmit outputs to the reception-side optical/electric conversion means of the plurality of transmission device sections, the optical transmission device performing wavelength-multiplexing transmission of the light signals of a plurality of wavelengths using the same optical fiber, each of the plurality of transmission device sections including reception-side wavelength information output means for outputting wavelength information which has a one-to-one correspondence with the wavelength of the second signal-rate light signal entered from the reception-side optical/electric conversion means as third wavelength information; and first reception-side wavelength monitoring comparison means for prestoring wavelength information of the second signal-rate light signal to be handled by the reception-side optical/electric conversion means as fourth wavelength information, monitoring and comparing in conformity the third wavelength information emitted from the reception-side wavelength information output means with the fourth wavelength information and for outputting a received output control signal in accordance with a comparison result, the reception-side optical/electric conversion means performing output control of the second signal-rate electric signal converted/emitted by itself in response to the received output control signal entered from the first reception-side wavelength monitoring comparison means.

According to a third aspect of the present invention, there is provided an optical transmission device using



wavelength multiplexing technique in which light signals of a plurality of wavelengths are transmitted in the same optical fiber, a transmission section of the optical transmission device comprising transmission-side optical/electric conversion means for converting a first signal-rate light signal from the outside of the device to an electric signal to output a first signal-rate electric signal, transmission-side signal processing means for performing a predetermined signal processing necessary for a transmission side of the first signal-rate electric signal from the transmission-side optical/electric conversion means to output a second signal-rate electric signal, transmission-side electric/optical conversion means for converting the second signal-rate electric signal from the transmission-side signal processing means to a second signal-rate light signal of a predetermined wavelength and controlling in accordance with a wavelength monitoring control signal entered from an in-device another means to output the second signal-rate light signal when the wavelength monitoring control signal is a meaningless signal or not to output the second signal-rate light signal when the wavelength monitoring control signal is a significant signal, wavelength identification control means forming the in-device another means for prestoring wavelength information of the second signal-rate light signal emitted from the transmission-side electric/optical conversion means, comparing in conformity the prestored wavelength information with the wavelength of the second signal-rate light signal actually emitted from the transmission-side electric/optical conversion means and for outputting the wavelength monitoring control signal as the meaningless signal in a case of



conformity to control an output of the transmission-side electric/optical conversion means or outputting the wavelength monitoring control signal as the significant signal in a case of non-conformity to control the output of the transmission-side electric/optical conversion means, and optical transmission output amplifying means for amplifying the second signal-rate light signal emitted from the transmission-side electric/optical conversion means to a predetermined level to emit an output.

According to a fourth aspect of the present invention, there is provided an optical output control system of an optical transmission device using wavelength multiplexing technique in which light signals of a plurality of wavelengths are transmitted in the same optical fiber. The optical output control system comprises a plurality of transmission device sections each including transmission-side optical/electric conversion means for converting a first signal-rate light signal from the outside of the device to an electric signal to output a first signal-rate electric signal, transmission-side rate conversion means for rate-converting the first signal-rate electric signal from the transmission-side optical/electric conversion means to a second signal-rate electric signal, overhead bit insertion means for inserting as an overhead bit a frame synchronous pattern generated in the device for performing synchronization with an opposite-side optical transmission device, a service data signal entered from the outside of the device, and the like into a predetermined bit position of the second signal-rate electric signal from the transmission-side rate conversion means to transmit an output to the opposite-side optical



transmission device, transmission-side electric/optical conversion means for converting the second signal-rate electric signal with the frame synchronous pattern and the overhead bit inserted therein from the overhead bit insertion means to a second signal-rate light signal of a predetermined wavelength and for controlling in accordance with a wavelength monitoring control signal entered from an in-device another means to output the second signal-rate light signal when the wavelength monitoring control signal is a meaningless signal or not to output the second signal-rate light signal when the wavelength monitoring control signal is a significant signal, wavelength identification control means forming the in-device another means for prestoring wavelength information of the second signal-rate light signal emitted from the transmission-side electric/optical conversion means, comparing in conformity the prestored wavelength information with the wavelength of the second signal-rate light signal actually emitted from the transmission-side electric/optical conversion means and for outputting the wavelength monitoring control signal as the meaningless signal in a case of conformity to control an output of the transmission-side electric/optical conversion means or outputting the wavelength monitoring control signal as the significant signal in a case of non-conformity to control the output of the transmission-side electric/optical conversion means, optical transmission output amplifying means for amplifying the second signal-rate light signal emitted from the transmission-side electric/optical conversion means to a predetermined level to transmit an output to a common section of the optical transmission device, reception-side



optical/electric conversion means for converting the second signal-rate light signal entered from the common section of the optical transmission device to the second signal-rate electric signal, frame synchronous means for frame-synchronizing the second signal-rate electric signal from the reception-side optical/electric conversion means based on the frame synchronous pattern inserted therein, overhead bit separation means for separating the service data signal and another overhead bit inserted therein from the second signal-rate electric signal synchronized by the frame synchronous means to transmit the overhead bit to the outside of the device, reception-side rate conversion means for rate-converting the second signal-rate electric signal with the service data signal and another overhead bit separated therefrom by the overhead bit separation means to the first signal-rate electric signal, and reception-side electric/optical conversion means for converting the first signal-rate electric signal emitted from the reception-side rate conversion means to a light signal to transmit the light signal to the outside of the device. The optical output control system comprises further comprises an optical synthesis branching section forming the common section of the optical transmission device including optical synthesis means for wavelength-multiplexing the second signal-rate light signals of different wavelengths emitted from the optical transmission output amplifying means of the plurality of transmission device sections to output a wavelength-multiplexed light signal, optical booster amplifying means for amplifying the wavelength-multiplexed light signal emitted from the optical synthesis means to a predetermined



level to transmit an output to an opposite-side optical transmission device via a transmission path, an optical preamplifying means for amplifying the wavelength-multiplexed light signal received/entered from the opposite-side optical transmission device through the transmission path to a predetermined level, and optical branching means for distributing/equalizing and branching the wavelength-multiplexed light signal emitted from the optical preamplifying means to the plurality of wavelengths to transmits the second signal-rate light signals to the plurality of transmission device sections.

Brief Description of the Drawing:

Figs. 1A and 1B are block diagrams showing a conventional optical transmission device;

Figs. 2A and 2B are block diagrams showing an optical transmission device according to a first embodiment of the present invention; and

Figs. 3A and 3B are block diagrams showing an optical transmission device according to a second embodiment of the present invention.

Description of the Preferred Embodiments:

The present invention will be described with reference to the drawings.

Referring now to Figs. 2A and 2B, description will be made as regards an optical transmission device according to a first embodiment of the present invention. In the manner which will presently be described in detail, the optical transmission device comprises n-transmission device sections



10-1 to 10-n and an optical synthesis branching section 20.

Each of the transmission device sections 10-1 to 10-n comprises an optical/electric conversion circuit 101 for converting an A kbit/s light signal to an electric signal; a rate conversion circuit 102 for rate-converting the A kbit/s signal converted to the electric signal by the optical/electric conversion circuit 101 to a B kbit/s ($A < B$) electric signal to add a frame synchronous pattern, an opposed station alarm signal, a service data signal, and the like as an overhead bit to the electric signal; an overhead bit insertion circuit 103 for generating therein a frame synchronous pattern and for inserting the frame synchronous pattern generated inside, the service data signal entered from the outside of the device, and the like as the overhead bit into a predetermined bit position of the B kbit/s electric signal entered from the rate conversion circuit 102; an electric/optical conversion circuit 1041 in an electric/optical conversion section 104 for converting the B kbit/s electric signal including the frame synchronous pattern, the service data signal, and the like entered from the overhead bit insertion circuit 103 to a light signal of a wavelength λ_1 to λ_n ; and an optical amplifier circuit 105 for amplifying the B kbit/s light signal emitted from the electric/optical conversion circuit 1041 to a predetermined level to transmit an output to the optical synthesis branching section 20.

Each of the transmission device sections 10-1 to 10-n further comprises an optical/electric conversion circuit 106 for converting the B kbit/s light signal entered from the optical synthesis branching section 20 to an electric signal;



a frame synchronous circuit 107 for frame-synchronizing the B kbit/s electric signal from the optical/electric conversion circuit 106; an overhead bit separation circuit 108 for fetching the service data signal from the B kbit/s electric signal from the frame synchronous circuit 107 to output the service data signal; a rate conversion circuit 109 for rate-converting the B kbit/s electric signal from the overhead bit separation circuit 108 to an A kbit/s electric signal; an electric/optical conversion circuit 110 for converting the A kbit/s electric signal from the rate conversion circuit 109 to a light signal to transmit the light signal to the outside of the device; a service data signal circuit 111 for receiving an order wire signal or another service data signal from the outside of the device to transmit an output to the overhead bit insertion circuit 103 and for outputting the service data signal entered from the overhead bit separation circuit 108 to the outside of the device; and a wavelength identification signal circuit 1042 in the electric/optical conversion section 104 for storing the wavelength of the B kbit/s light signal emitted from the electric/optical conversion circuit 1041 as wavelength identification information.

The optical synthesis branching section 20 comprises an optical synthesis circuit 201 for wavelength-multiplexing the B kbit/s light signals of different wavelengths λ_1 to λ_n emitted from the n-transmission device sections 10-1 to 10-n to output a wavelength-multiplexed light signal; an optical booster amplifier 202 for amplifying the wavelength-multiplexed light signal emitted from the optical synthesis circuit 201 to a predetermined level to transmit an output to



an opposite-side optical transmission device via a transmission path; an optical preamplifier 203 for amplifying the wavelength-multiplexed light signal received/entered from the opposite-side optical transmission device through the transmission path to a predetermined level; and an optical branching circuit 204 for distributing/equalizing the wavelength-multiplexed light signal emitted from the optical preamplifier 203 for each wavelength and subsequently branching the light signal into n-wavelengths to transmit outputs to the n-transmission device sections 10-1 to 10-n.

The optical transmission device further comprises a wavelength identification signal monitor 30 which prestores wavelength identification information emitted from the electric/optical conversion circuits 1041 mounted on the n-transmission device sections 10-1 to 10-n, compares in conformity the prestored wavelength identification information with the wavelength identification information from the wavelength identification signal circuit 1042 in the electric/optical conversion section 104 in which the wavelength identification information of the actually mounted electric/optical conversion circuit 1041 is stored, and controls light signal output operation of each electric/optical conversion circuit 1041.

The description will now be directed to an operation of the optical transmission device of Figs. 2A and 2B. The optical/electric conversion circuit 101 of the transmission device section 10-1 converts the A kbit/s light signal entered from the outside of the device to an electric signal to transmit an output to the rate conversion circuit 102. The rate conversion circuit 102 rate-converts the A kbit/s



electric signal to a B kbit/s ($A < B$) electric signal in order to add the frame synchronous pattern, the service data signal or the like as the overhead bit to the A kbit/s electric signal emitted from the optical/electric conversion circuit 101. The overhead bit insertion circuit 103 generates inside the frame synchronous pattern while inserting the frame synchronous pattern generated inside, the service data signal entered from the service data signal circuit 111 or the like into a predetermined bit position of the B kbit/s electric signal entered from the rate conversion circuit 102. The B kbit/s electric signal emitted from the overhead bit insertion circuit 103 is converted to a light signal of a wavelength λ_1 by the electric/optical conversion circuit 1041, and transmitted to the optical amplifier circuit 105. The optical amplifier circuit 105 amplifies the light signal of the wavelength λ_1 entered from the electric/optical conversion circuit 1041 to the predetermined level and subsequently transmits the output to the optical synthesis branching section 20. In the same manner, the transmission device section 10- n transmits the light signal of the wavelength λ_n to the optical synthesis branching section 20.

The optical synthesis circuit 201 constituted of a photocoupler or the like of the optical synthesis branching section 20 multiplexes the B kbit/s light signal of the wavelength λ_1 entered from the transmission device section 10-1 and the B kbit/s light signal of the wavelength λ_n entered from the transmission device section 10- n to output a wavelength-multiplexed light signal. The optical booster amplifier 202 amplifies the wavelength-multiplexed light signal of the wavelengths λ_1 to λ_n entered from the optical



synthesis circuit 201 to the predetermined level to transmit an output to the opposite-side optical transmission device via the transmission path.

The optical preamplifier 203 on the reception side of the optical synthesis branching section 20 amplifies the wavelength-multiplexed light signal entered from the transmission-side optical booster amplifier 202 of the opposite-side optical transmission device via the transmission path to the predetermined level, and transmits an output to the optical branching circuit 204. The optical branching circuit 204 branches the wavelength-multiplexed light signal of the wavelengths λ_1 to λ_n from the optical preamplifier 203 to each wavelength, and transmits the B kbit/s light signal of the wavelength λ_1 to the transmission device section 10-1 and the B kbit/s light signal of the wavelength λ_n to the transmission device section 10-n.

The optical/electric conversion circuits 106 of the transmission device sections 10-1 to 10-n convert B kbit/s light signals of the wavelengths λ_1 to λ_n entered from the optical branching circuit 204 of the optical synthesis branching section 20 to electric signals. The frame synchronous circuit 107 frame-synchronizes the B kbit/s electric signal entered from the optical/electric conversion circuit 106 to transmit an output to the overhead bit separation circuit 108. The overhead bit separation circuit 108 fetches the service data signal, or the like added as the overhead bit from the B kbit/s electric signal frame-synchronized by the frame synchronous circuit 107 to transmit an output to the service data circuit 111 while transmitting the remaining B kbit/s electric signal with the service data



signal, or the like fetched therefrom to the rate conversion circuit 109. The rate conversion circuit 109 rate-converts the B kbit/s electric signal from the overhead bit separation circuit 108 to an A kbit/s electric signal to transmit an output to the electric/optical conversion circuit 110. The electric/optical conversion circuit 110 converts the A kbit/s electric signal from the overhead bit separation circuit 108 to a light signal to transmit the light signal to the outside of the device. Subsequently, the service data signal circuit 111 transmits the order wire signal or another service data signal entered from the outside of the device to the overhead bit insertion circuit 103, and transmits the order wire signal or another service data signal entered from the overhead bit separation circuit 108 to the outside of the device.

If the electric/optical conversion section 104 of the transmission device section 10-1 malfunctions, is therefore to be replaced with a spare electric/optical conversion section of the wavelength λ_1 , but is by mistake replaced with a spare electric/optical conversion section of the wavelength λ_n of the transmission device section 10-n, the wavelength identification signal monitor 30 reads the wavelength identification information from the replaced wavelength identification signal circuit 1042 of the wavelength λ_n , compares the information with the prestored wavelength identification information of the electric/optical conversion circuit 1041 of the wavelength λ_1 , and judges the conformity. Since both the wavelength identification information do not conform with each other, the wavelength identification signal monitor 30 transmits a shutdown control



signal to the spare electric/optical conversion circuit 1041 of the wavelength λ_n of the replaced/mounted electric/optical conversion section 104 on the transmission device section 10-1, so that no light signal of the wavelength λ_n is emitted from the spare electric/optical conversion circuit 1041.

Additionally, in the optical transmission device of Fig. 2, the electric/optical conversion section 104 is integrally constituted of the electric/optical conversion circuit 1041 and the wavelength identification signal circuit 1042, and the wavelength identification signal monitor 30 is provided in common to the transmission device sections outside the transmission device sections 10-1 to 10-n and separately therefrom. In another embodiment, the electric/optical conversion circuit 1041 and the wavelength identification signal circuit 1042 may be constituted independently instead of integrally, and the function of the wavelength identification signal monitor 30 is provided in the independent wavelength identification signal circuit 1042.

Specifically, the independent wavelength identification signal circuit 1042 also has a control function in which the wavelength information of the second signal-rate light signal emitted from the electric/optical conversion circuit 1041 is prestored, the prestored wavelength information is compared, in conformity, with the wavelength of the actual second signal-rate light signal emitted from the electric/optical conversion circuit 1041, and a wavelength monitoring control signal is emitted as a meaningless signal in a case of conformity or emitted as a significant signal in a case of non-conformity to control the output of the electric/optical



conversion circuit 1041.

As aforementioned, in the wavelength multiplexing system optical transmission device in which light signals of a plurality of wavelengths are transmitted in the same optical fiber, even if at the time of malfunction of the transmission-side electric/optical conversion section for transmitting light signals to the transmission path, a spare electric/optical conversion section of another wavelength is mounted for replacement by mistake, no light signal is emitted from the wrongly mounted spare electric/optical conversion section. Therefore, the original system operation of the mounted spare electric/optical conversion section being operated is not adversely affected.

Referring to Figs. 3A and 3B, the description will be made as regards an optical transmission device according to a second embodiment of the present invention. Similar parts are designated by like reference numerals.

The optical transmission device comprises n-transmission device sections 60-1 to 60-n in addition to the optical synthesis branching section 20. Each of the transmission device sections 60-1 to 60-n comprises an optical/electric conversion circuit 601 for converting an A kbit/s light signal to an A kbit/s electric signal; a rate conversion circuit 602 for rate-converting the A kbit/s electric signal emitted from the optical/electric conversion circuit 601 to a B kbit/s ($A < B$) electric signal; an overhead bit insertion circuit 603 for inserting as an overhead bit a frame synchronous pattern generated inside to perform frame synchronization with an opposite-side optical transmission device, a service data signal entered from the outside of the



device via the service data signal circuit 611 to be transmitted to the opposite-side optical transmission device, and the like; an electric/optical conversion section 604 including an electric/optical conversion circuit 6041 which converts the B kbit/s electric signal including the frame synchronous pattern, the service data signal, and the like emitted from the overhead bit insertion circuit 603 to a light signal of one of the wavelengths λ_1 to λ_n to output a B kbit/s light signal and which is controlled by a transmission output control signal entered from a wavelength monitoring comparator 70 to perform output control of the B kbit/s light signal converted/emitted by itself, and a wavelength information output circuit 6042 which outputs wavelength information having a one-to-one correspondence with the wavelength of the light signal emitted from the electric/optical conversion circuit 6041; and an optical amplifier circuit 605 for amplifying the B kbit/s light signal emitted from the electric/optical conversion circuit 6041 to a predetermined level to transmit an output to the optical synthesis branching section 20.

Each of the transmission device sections 60-1 to 60-n further comprises an optical/electric conversion circuit section 606 including an optical/electric conversion circuit 6061 which converts the B kbit/s light signal entered from the optical synthesis branching section 20 to a B kbit/s electric signal and which is controlled by a received output control signal entered from the wavelength monitoring comparator 70 to perform output control of the B kbit/s electric signal converted/emitted by itself, and a wavelength information output circuit 6062 which outputs wavelength



information having a one-to-one correspondence with the wavelength-of the B kbit/s light signal to be entered into the optical/electric conversion circuit 6061; a frame synchronous circuit 607 for frame-synchronizing the B kbit/s electric signal emitted from the optical/electric conversion circuit 6061 based on the frame synchronous pattern inserted on the transmission side; an overhead bit separation circuit 608 for separating the overhead bit from the B kbit/s electric signal emitted from the frame synchronous circuit 607 to fetch and output the service data signal; a rate conversion circuit 609 for rate-converting the B kbit/s electric signal with the overhead bit separated therefrom emitted from the overhead bit separation circuit 608 to an A kbit/s electric signal; an electric/optical conversion circuit 610 for converting the output of the rate conversion circuit 609 from the A kbit/s electric signal to an A kbit/s light signal to transmit the light signal to the outside of the device; and a service data signal circuit 611 for receiving an input of an order wire signal or another service data signal from the outside of the device to transmit an output to the overhead bit insertion circuit 603 and for transmitting the service data signal entered from the overhead bit separation circuit 608 to the outside of the device.

The above-mentioned wavelength monitoring compactor 70 prestores wavelength information handled by the electric/optical conversion circuits 6041 and the optical/electric conversion circuits 6061 mounted on the n-transmission device sections 60-1 to 60-n, compares in conformity the prestored wavelength information with the wavelength information



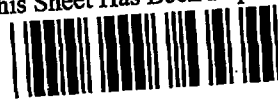
emitted from the actually mounted wavelength information output circuit 6042 of the electric/optical conversion section 604, controls in such a manner that the B kbit/s light signal converted by the electric/optical conversion circuit 6041 is emitted at the time of conformity, or controls in such a manner that no B kbit/s light signal is emitted at the time of non-conformity and transmits to the outside a transmission-side alarm signal x indicating that the electric/optical conversion section 604 is wrongly mounted, and which compares in conformity the prestored wavelength information with the wavelength information emitted from the wavelength information output circuit 6062 of the optical/electric conversion section 606, controls in such a manner that the B kbit/s electric signal converted by the optical/electric conversion circuit 6061 is emitted at the time of conformity, or controls in such a manner that no B kbit/s electric signal is emitted at the time of non-conformity and transmits to the outside a reception-side alarm signal y indicating that the optical/electric conversion section 606 is wrongly mounted.

The description will now be directed to an operation of the optical transmission device of Figs. 3A and 3B. The optical/electric conversion circuit 601 of the transmission device section 60-1 converts the A kbit/s light signal entered from the outside of the device to an electric signal to transmit an output to the rate conversion circuit 602. The rate conversion circuit 602 rate-converts the A kbit/s electric signal to a B kbit/s ($A < B$) electric signal in order to add the frame synchronous pattern, the service data signal, and the like as the overhead bit to the A kbit/s electric



signal emitted from the optical/electric conversion circuit 601. The overhead bit insertion circuit 603 inserts the frame synchronous pattern generated inside, the service data signal entered from the service data signal circuit 611, and the like to the predetermined bit position of the B kbit/s electric signal entered from the rate conversion circuit 602. The B kbit/s electric signal emitted from the overhead bit insertion circuit 603 is converted to a light signal of a wavelength λ_1 by the electric/optical conversion circuit 6041, and transmitted to the optical amplifier circuit 605. The optical amplifier circuit 605 amplifies the light signal of the wavelength λ_1 entered from the electric/optical conversion circuit 6041 to the predetermined level and subsequently transmits the output to the optical synthesis branching section 20. In the same manner, the transmission device section 60-n transmits the light signal of the wavelength λ_n to the optical synthesis branching section 20.

The optical synthesis circuit 201 constituted of a photocoupler, or the like of the optical synthesis branching section 20 multiplexes the light signal of the wavelength λ_1 entered from the optical amplifier circuit 605 of the transmission device section 60-1 and the light signal of the wavelength λ_n entered from the optical amplifier circuit 605 of the transmission device section 60-n to output a wavelength-multiplexed light signal. The optical booster amplifier 202 amplifies the wavelength-multiplexed light signal of the wavelengths λ_1 to λ_n entered from the optical synthesis circuit 201 to the predetermined level to transmit an output to the opposite-side optical transmission device via the transmission path.



The optical preamplifier 203 of the optical synthesis branching section 20 amplifies to a predetermined level the wavelength-multiplexed light signal which is received/entered from the opposite-side optical transmission device via the transmission path, and transmits an output to the optical branching circuit 204. The optical branching circuit 204 distributes/equalizes the wavelength-multiplexed light signal of the wavelengths λ_1 to λ_n from the optical preamplifier 203 to each wavelength, subsequently branches the light signal to the wavelengths, and transmits the light signal of the wavelength λ_1 to the transmission device section 60-1 and the light signal of the wavelength λ_n to the transmission device section 60-n.

The optical/electric conversion circuits 6061 of the transmission device sections 60-1 to 60-n convert the light signals of the wavelengths λ_1 to λ_n entered from the optical branching circuit 204 of the optical synthesis branching section 20 to B kbit/s electric signals. The frame synchronous circuit 607 frame-synchronizes the B kbit/s electric signal entered from the optical/electric conversion circuit 6061 to transmit an output to the overhead bit separation circuit 608. The overhead bit separation circuit 608 separates the overhead bit from the frame-synchronized B kbit/s electric signal and fetches the service data signal, and the like added to the overhead bit to transmit an output to the service data circuit 611, while outputting the remaining B kbit/s electric signal with the overhead bit separated therefrom to the rate conversion circuit 609. The rate conversion circuit 609 rate-converts the B kbit/s electric signal from the overhead bit separation circuit 608



to an A kbit/s electric signal to transmit an output to the electric/optical conversion circuit 610. The electric/optical conversion circuit 610 converts the A kbit/s electric signal from the overhead bit separation circuit 608 to an A kbit/s light signal to transmit the light signal to the outside of the device. Subsequently, the service data signal circuit 611 transmits the order wire signal or another service data signal entered from the outside of the device to the overhead bit insertion circuit 603, and transmits the service data signal separated by the overhead bit separation circuit 608 to the outside of the device.

If the electric/optical conversion section 604 of the transmission device section 60-1 is to be replaced with a spare electric/optical conversion section of the wavelength λ_1 because of occurrence of failure, but is by mistake replaced with a spare electric/optical conversion section of the wavelength λ_n of the transmission device section 60-n, the wavelength monitoring comparator 70 takes the wavelength information of the wavelength λ_n from the replaced wavelength information output circuit 6042, compares the information with the prestored wavelength information of the wavelength λ_1 to be handled by the electric/optical conversion circuit 6041, and judges the conformity. Since both the wavelength information do not conform with each other, the wavelength monitoring comparator 70 transmits a transmission output control signal to the spare electric/optical conversion circuit 6041 of the wrongly replaced/mounted electric/optical conversion section 604 of the wavelength λ_n on the transmission device section 60-1, performs shutdown control in such a manner that no light



signal of the wavelength λ_n is emitted from the wrongly replaced/mounted spare electric/optical conversion section 604, and emits a transmission-side alarm signal x indicating that the electric/optical conversion section 604 is wrongly mounted.

Moreover, if the optical/electric conversion section 106 of the transmission device section 60-1 is to be replaced with a spare optical/electric conversion section of the wavelength λ_1 because of occurrence of failure, but is by mistake replaced with a spare optical/electric conversion section of the wavelength λ_n of the transmission device section 60-n, the wavelength monitoring comparator 70 takes the wavelength information of the wavelength λ_n from the replaced wavelength information output circuit 6062, compares the information with the prestored wavelength information of the wavelength λ_1 to be handled by the optical/electric conversion circuit 6061, and judges the conformity. Since both the wavelength information do not conform with each other, the wavelength monitoring comparator 70 transmits a received output control signal to the spare optical/electric conversion circuit 6061 of the wrongly replaced/mounted optical/electric conversion section 606 of the wavelength λ_n on the transmission device section 60-1, performs shutdown control in such a manner that no converted electric signal is emitted from the wrongly replaced/mounted spare optical/electric conversion circuit 6061, and transmits to the outside a reception-side alarm signal y indicating that the optical/electric conversion section 606 is wrongly mounted.

Furthermore, in the optical transmission device of Figs. 3A and 3B, the electric/optical conversion section 604 is



integrally constituted of the electric/optical conversion circuit 6041 and the wavelength information output circuit 6042, the optical/ electric conversion section 606 is integrally constituted of the optical/electric conversion circuit 1061 and the wavelength information output circuit 6062, and the wavelength monitoring comparator 70 is provided in common outside the transmission device sections 60-1 to 60-n and independently therefrom. In another embodiment, the function of the wavelength monitoring comparator 70 may be provided in common to only the transmission section or to only the reception section, or the function of the wavelength monitoring comparator 70 may be, for each transmission device section, integrated with the electric/optical conversion circuit 6041 and the wavelength information output circuit 6042 on the transmission side and with the optical/electric conversion circuit 6061 and the wavelength information output circuit 1062 on the reception side.

As aforementioned, in the wavelength multiplexing system optical transmission device in which the light signals of a plurality of different wavelengths are transmitted using the same optical fiber, even if the transmission-side electric/optical conversion section for transmitting the light signal to the light transmission path is replaced by mistake with a spare electric/optical conversion section of another wavelength at the time of failure, or even if the reception-side optical/electric conversion section for receiving the light signal from the light transmission path is replaced by mistake with a spare optical/electric conversion section of another wavelength at the time of failure, no converted light signal or electric signal is

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emitted from the wrongly replaced/mounted spare electric/optical conversion section or spare optical/electric conversion section. Therefore, the original operation of the system being operated is not adversely affected.

Additionally, since the transmission-side alarm signal or the reception-side alarm signal indicating that the conversion section is mounted by mistake is emitted, the cause of service disconnection can be quickly clarified, and the service disconnection time can be reduced.

**WHAT IS CLAIMED IS:**

1. An optical transmission device which comprises:
a plurality of transmission device sections each including transmission-side optical/electric conversion means for converting a first signal-rate light signal entered from the outside of the device to an electric signal to output a first signal-rate electric signal, transmission-side signal processing means for performing a predetermined signal processing necessary for a transmission side of said first signal-rate electric signal emitted from said transmission-side optical/electric conversion means to output a second signal-rate electric signal, transmission-side electric/optical conversion means for converting said second signal-rate electric signal emitted from said transmission-side signal processing means to a second signal-rate light signal to transmit an output to in-device another first means, reception-side optical/electric conversion means for converting said second signal-rate light signal entered from said in-device another first means to an electric signal, received signal processing means for performing rate conversion or another signal processing necessary for a reception side of said second signal-rate electric signal emitted from said reception-side optical/electric conversion means to output said first signal-rate electric signal, and reception-side electric/optical conversion means for converting said first signal-rate electric signal emitted from said received signal processing means to a light signal to transmit said first signal-rate light signal to said outside of the device; and



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an optical synthesis branching section as said in-device first means including optical synthesis means for wavelength-multiplexing a plurality of light signals of different wavelengths emitted from said transmission-side electric/optical conversion means of said plurality of transmission device sections to output a wavelength-multiplexed light signal, an optical booster amplifier for amplifying said wavelength-multiplexed light signal emitted from said optical synthesis means to a predetermined level to transmit an output to an opposite-side optical transmission device via a light transmission path, an optical preamplifier for amplifying said wavelength-multiplexed light signal entered from said opposite-side optical transmission device via said light transmission path to a predetermined level, and optical branching means for distributing/equalizing and branching said wavelength-multiplexed light signal emitted from said optical preamplifier to the wavelengths to transmit outputs to said reception-side optical/electric conversion means of said plurality of transmission device sections, said optical transmission device performing wavelength-multiplexing transmission of the light signals of a plurality of wavelengths using the same optical fiber,

each of said plurality of transmission device sections including transmission-side wavelength information output means for outputting wavelength information which has a one-to-one correspondence with the wavelength of said second signal-rate light signal emitted from said transmission-side electric/optical conversion means as first wavelength information; and first transmission-side wavelength monitoring comparison means for prestoring wavelength



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information of said second signal-rate light signal to be handled by said transmission-side electric/optical conversion means as second wavelength information, monitoring and comparing in conformity said first wavelength information of said transmission-side wavelength information output means with said second wavelength information and for outputting a transmission output control signal in accordance with a comparison result, said transmission-side electric/optical conversion means performing output control of said second signal-rate light signal converted/emitted by itself in response to said transmission output control signal entered from said first transmission-side wavelength monitoring comparison means.

2. An optical transmission device as claimed in claim 1, wherein said transmission-side electric/optical conversion means, said transmission-side wavelength information output means and said first transmission-side wavelength monitoring comparison means are integrally constituted.

3. An optical transmission device as claimed in claim 1, wherein instead of said first transmission-side wavelength monitoring comparison means of said plurality of transmission device sections, second transmission-side wavelength monitoring comparison means common to the transmission device sections is disposed outside said plurality of transmission device sections, and the second transmission-side wavelength monitoring comparison means prestores said second wavelength information emitted from said transmission-side electric/optical conversion means of said plurality of transmission device sections, takes, monitors and compares in conformity said first wavelength information emitted from



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said transmission-side wavelength information output means of said plurality of transmission device sections with said second wavelength information and outputs a transmission output control signal in accordance with a comparison result to perform said output control of said transmission-side electric/optical conversion means.

4. An optical transmission device which comprises:
a plurality of transmission device sections each including transmission-side optical/electric conversion means for converting a first signal-rate light signal entered from the outside of the device to an electric signal to output a first signal-rate electric signal, transmission-side signal processing means for performing a predetermined signal processing necessary for a transmission side of said first signal-rate electric signal emitted from said transmission-side optical/electric conversion means to output a second signal-rate electric signal, transmission-side electric/optical conversion means for converting said second signal-rate electric signal emitted from said transmission-side signal processing means to a second signal-rate light signal to transmit an output to in-device another first means, reception-side optical/electric conversion means for converting said second signal-rate light signal entered from said in-device another first means to an electric signal, received signal processing means for performing rate conversion or another signal processing necessary for a reception side of said second signal-rate electric signal emitted from said reception-side optical/electric conversion means to output said first signal-rate electric signal, and reception-side electric/optical conversion means for



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converting said first signal-rate electric signal emitted from said received signal processing means to a light signal to transmit said first signal-rate light signal to said outside of the device; and

an optical synthesis branching section as said in-device first means including optical synthesis means for wavelength-multiplexing a plurality of light signals of different wavelengths emitted from said transmission-side electric/optical conversion means of said plurality of transmission device sections to output a wavelength-multiplexed light signal, an optical booster amplifier for amplifying said wavelength-multiplexed light signal emitted from said optical synthesis means to a predetermined level to transmit an output to an opposite-side optical transmission device via a light transmission path, an optical preamplifier for amplifying said wavelength-multiplexed light signal entered from said opposite-side optical transmission device through said light transmission path to a predetermined level, and optical branching means for distributing/equalizing and branching said wavelength-multiplexed light signal emitted from said optical preamplifier to the wavelengths to transmit outputs to said reception-side optical/electric conversion means of said plurality of transmission device sections, said optical transmission device performing wavelength-multiplexing transmission of the light signals of a plurality of wavelengths using the same optical fiber,

each of said plurality of transmission device sections including reception-side wavelength information output means for outputting wavelength information which has a one-to-one correspondence with the wavelength of said second signal-rate



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light signal entered from said reception-side optical/electric conversion means as third wavelength information; and first reception-side wavelength monitoring comparison means for prestoring wavelength information of said second signal-rate light signal to be handled by said reception-side optical/electric conversion means as fourth wavelength information, monitoring and comparing in conformity said third wavelength information emitted from said reception-side wavelength information output means with said fourth wavelength information and for outputting a received output control signal in accordance with a comparison result, said reception-side optical/electric conversion means performing output control of said second signal-rate electric signal converted/emitted by itself in response to said received output control signal entered from said first reception-side wavelength monitoring comparison means.

5. An optical transmission device as claimed in claim 4, wherein said reception-side optical/electric conversion means, said reception-side wavelength information output means and said first reception-side wavelength monitoring comparison means are integrally constituted.

6. An optical transmission device as claimed in claim 4, wherein instead of said first reception-side wavelength monitoring comparison means of said plurality of transmission device sections, second reception-side wavelength monitoring comparison means common to the transmission device sections is disposed outside said plurality of transmission device sections, which prestores said third wavelength information entered from said reception-side optical/electric conversion means of said plurality of transmission device sections,



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takes, monitors and compares in conformity said fourth wavelength information emitted from said reception-side wavelength information output means of said plurality of transmission device sections with said fourth wavelength information, and outputs a received output control signal in accordance with a comparison result to perform said output control of said reception-side optical/electric conversion means.

7. An optical transmission device as claimed in claim 3, wherein said second transmission-side wavelength monitoring comparison means and said second reception-side wavelength monitoring comparison means are integrally constituted outside said plurality of transmission device sections.

8. An optical transmission device as claimed in claim 1, wherein said transmission-side signal processing means comprises transmission-side rate conversion means for rate-converting said first signal-rate electric signal emitted from said transmission-side optical/electric conversion means to said second signal-rate electric signal, and overhead bit insertion means for inserting as an overhead bit a frame synchronous pattern for performing synchronization with said opposite-side optical transmission device, a service data signal entered from said outside of the device to be transmitted to said opposite-side optical transmission device, and the like into a predetermined bit position of said second signal-rate electric signal emitted from said transmission-side rate conversion means; and said reception-side signal processing means comprises frame synchronous means for frame-synchronizing said second signal-rate electric signal emitted



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from said reception-side optical/electric conversion means based on said frame synchronous pattern inserted on said transmission side, and overhead bit separation means for separating said overhead bit from said second signal-rate electric signal emitted from said frame synchronous means to fetch and transmit said service data signal to said outside of the device.

9. An optical transmission device using wavelength multiplexing technique in which light signals of a plurality of wavelengths are transmitted in the same optical fiber, a transmission section of said optical transmission device comprising:

transmission-side optical/electric conversion means for converting a first signal-rate light signal from the outside of the device to an electric signal to output a first signal-rate electric signal;

transmission-side signal processing means for performing a predetermined signal processing necessary for a transmission side of said first signal-rate electric signal from said transmission-side optical/electric conversion means to output a second signal-rate electric signal;

transmission-side electric/optical conversion means for converting said second signal-rate electric signal from said transmission-side signal processing means to a second signal-rate light signal of a predetermined wavelength and controlling in accordance with a wavelength monitoring control signal entered from an in-device another means to output said second signal-rate light signal when said wavelength monitoring control signal is a meaningless signal or not to output said second signal-rate light signal when



said wavelength monitoring control signal is a significant signal;

wavelength identification control means forming said in-device another means for prestoring wavelength information of said second signal-rate light signal emitted from said transmission-side electric/optical conversion means, comparing in conformity said prestored wavelength information with the wavelength of said second signal-rate light signal actually emitted from said transmission-side electric/optical conversion means and for outputting said wavelength monitoring control signal as the meaningless signal in a case of conformity to control an output of said transmission-side electric/optical conversion means or outputting said wavelength monitoring control signal as the significant signal in a case of non-conformity to control the output of said transmission-side electric/optical conversion means; and optical transmission output amplifying means for amplifying said second signal-rate light signal emitted from said transmission-side electric/optical conversion means to a predetermined level to emit an output.

10. An optical output control system of the optical transmission device as claimed in claim 9, wherein

said transmission-side electric/optical conversion means and said wavelength identification control means are integrally constituted,

said wavelength identification control means prestores the wavelength information of said second signal-rate light signal emitted from said transmission-side electric/optical conversion means, only outputs said prestored wavelength information as a wavelength identification signal, has no



function of controlling the output of said transmission-side electric/optical conversion means, and is provided with wavelength identification signal monitoring means for monitoring said wavelength identification signal from said wavelength identification means separate from said transmission section on the transmission side of said optical transmission device, and

said wavelength identification signal monitoring means prestores the wavelength information of said second signal-rate light signal emitted from said transmission-side electric/optical conversion means, compares in conformity said prestored wavelength information with said wavelength identification signal read from said actually mounted wavelength identification means, and outputs said wavelength monitoring control signal as the meaningless signal in the case of conformity to control the output of said transmission-side electric/optical conversion means or outputs said wavelength monitoring control signal as the significant signal in the case of non-conformity to control the output of said transmission-side electric/optical conversion means.

11. An optical output control system of the optical transmission device as claimed in claim 9, which comprises a plurality of transmission sections of said optical transmission device, and optical synthesis means for wavelength-multiplexing said second light signals of different wavelengths from said transmission-side electric/optical conversion means of said plurality of transmission sections to transmit a wavelength-multiplexed light signal to a transmission path.



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12. An optical output control system of the optical transmission device as claimed in claim 10, wherein said wavelength identification signal monitoring means prestores the wavelength information of said second light signals emitted from said transmission-side electric/optical conversion means of the plurality of transmission sections of said optical transmission device, and compares in conformity the prestored wavelength information of said second light signals with the wavelength identification signals of said second light signals actually emitted from said wavelength identification means to control said transmission-side electric/optical conversion means.

13. An optical output control system of the optical transmission device as claimed in claim 9, wherein said transmission-side signal processing means comprises transmission-side rate conversion means for rate-converting said first signal-rate electric signal from said transmission-side optical/electric conversion means to the second signal-rate electric signal; and overhead bit insertion means for inserting as an overhead bit a frame synchronous pattern generated in the device for performing synchronization with said opposite-side optical transmission device, a service data signal entered from said outside of the device, and the like into a predetermined bit position of said second signal-rate electric signal from said transmission-side rate conversion means to transmit an output to said opposite-side optical transmission device.

14. An optical output control system of an optical transmission device using wavelength multiplexing technique in which light signals of a plurality of wavelengths are



transmitted in the same optical fiber, comprising:

a plurality of transmission device sections each including:

transmission-side optical/electric conversion means for converting a first signal-rate light signal from the outside of the device to an electric signal to output a first signal-rate electric signal;

transmission-side rate conversion means for rate-converting said first signal-rate electric signal from said transmission-side optical/electric conversion means to a second signal-rate electric signal;

overhead bit insertion means for inserting as an overhead bit a frame synchronous pattern generated in the device for performing synchronization with an opposite-side optical transmission device, a service data signal entered from said outside of the device, and the like into a predetermined bit position of said second signal-rate electric signal from said transmission-side rate conversion means to transmit an output to said opposite-side optical transmission device;

transmission-side electric/optical conversion means for converting said second signal-rate electric signal with said frame synchronous pattern and said overhead bit inserted therein from said overhead bit insertion means to a second signal-rate light signal of a predetermined wavelength and for controlling in accordance with a wavelength monitoring control signal entered from an in-device another means to output said second signal-rate light signal when said wavelength monitoring control signal is a meaningless signal or not to output said second signal-rate light signal when



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said wavelength monitoring control signal is a significant signal;

wavelength identification control means forming said in-device another means for prestoring wavelength information of said second signal-rate light signal emitted from said transmission-side electric/optical conversion means, comparing in conformity said prestored wavelength information with the wavelength of said second signal-rate light signal actually emitted from said transmission-side electric/optical conversion means and for outputting said wavelength monitoring control signal as the meaningless signal in a case of conformity to control an output of said transmission-side electric/optical conversion means or outputting said wavelength monitoring control signal as the significant signal in a case of non-conformity to control the output of said transmission-side electric/optical conversion means;

optical transmission output amplifying means for amplifying said second signal-rate light signal emitted from said transmission-side electric/optical conversion means to a predetermined level to transmit an output to a common section of said optical transmission device;

reception-side optical/electric conversion means for converting said second signal-rate light signal entered from the common section of said optical transmission device to said second signal-rate electric signal;

frame synchronous means for frame-synchronizing said second signal-rate electric signal from said reception-side optical/electric conversion means based on the frame synchronous pattern inserted therein;



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overhead bit separation means for separating said service data signal and another overhead bit inserted therein from said second signal-rate electric signal synchronized by said frame synchronous means to transmit the overhead bit to said outside of the device;

reception-side rate conversion means for rate-converting said second signal-rate electric signal with said service data signal and another overhead bit separated therefrom by said overhead bit separation means to said first signal-rate electric signal; and

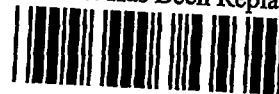
reception-side electric/optical conversion means for converting said first signal-rate electric signal emitted from said reception-side rate conversion means to a light signal to transmit the light signal to said outside of the device; and

an optical synthesis branching section forming the common section of said optical transmission device including:

optical synthesis means for wavelength-multiplexing said second signal-rate light signals of different wavelengths emitted from said optical transmission output amplifying means of said plurality of transmission device sections to output a wavelength-multiplexed light signal;

optical booster amplifying means for amplifying said wavelength-multiplexed light signal emitted from said optical synthesis means to a predetermined level to transmit an output to an opposite-side optical transmission device via a transmission path;

an optical preamplifying means for amplifying said wavelength-multiplexed light signal received/entered from said opposite-side optical transmission device through said



transmission path to a predetermined level; and

optical branching means for distributing/equalizing and branching said wavelength-multiplexed light signal emitted from said optical preamplifying means to the plurality of wavelengths to transmits said second signal-rate light signals to said plurality of transmission device sections.

15. An optical output control system of the optical transmission device as claimed in claim 6, wherein

said transmission-side electric/optical conversion means and said wavelength identification control means are integrally constituted,

said wavelength identification control means prestores the wavelength information of said second signal-rate light signal emitted from said transmission-side electric/optical conversion means, outputs said prestored wavelength information as a wavelength identification signal, and is provided with wavelength identification signal monitoring means for monitoring said wavelength identification signal from said wavelength identification means separate from said transmission section on the transmission side of said optical transmission device, and

said wavelength identification signal monitoring means prestores the wavelength information of said second signal-rate light signal emitted from said transmission-side electric/optical conversion means, compares in conformity said prestored wavelength information with said wavelength identification signal read from said actually mounted wavelength identification means, and outputs said wavelength monitoring control signal as the meaningless signal in a case of conformity to control an output of said transmission-side



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electric/optical conversion means or outputs said wavelength monitoring control signal as the significant signal in a case of non-conformity to control the output of said transmission-side electric/optical conversion means.