



FIG. 1

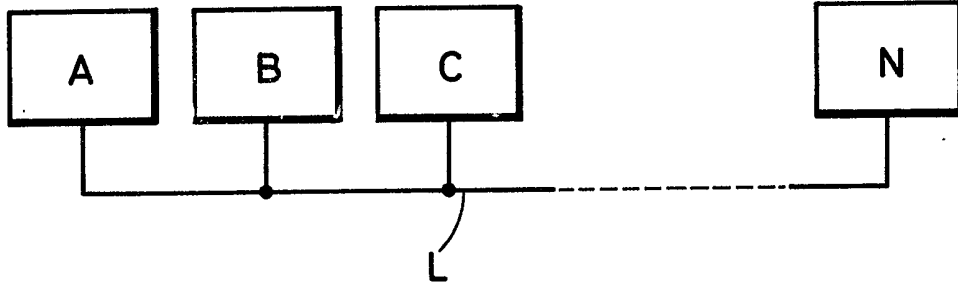


FIG. 2

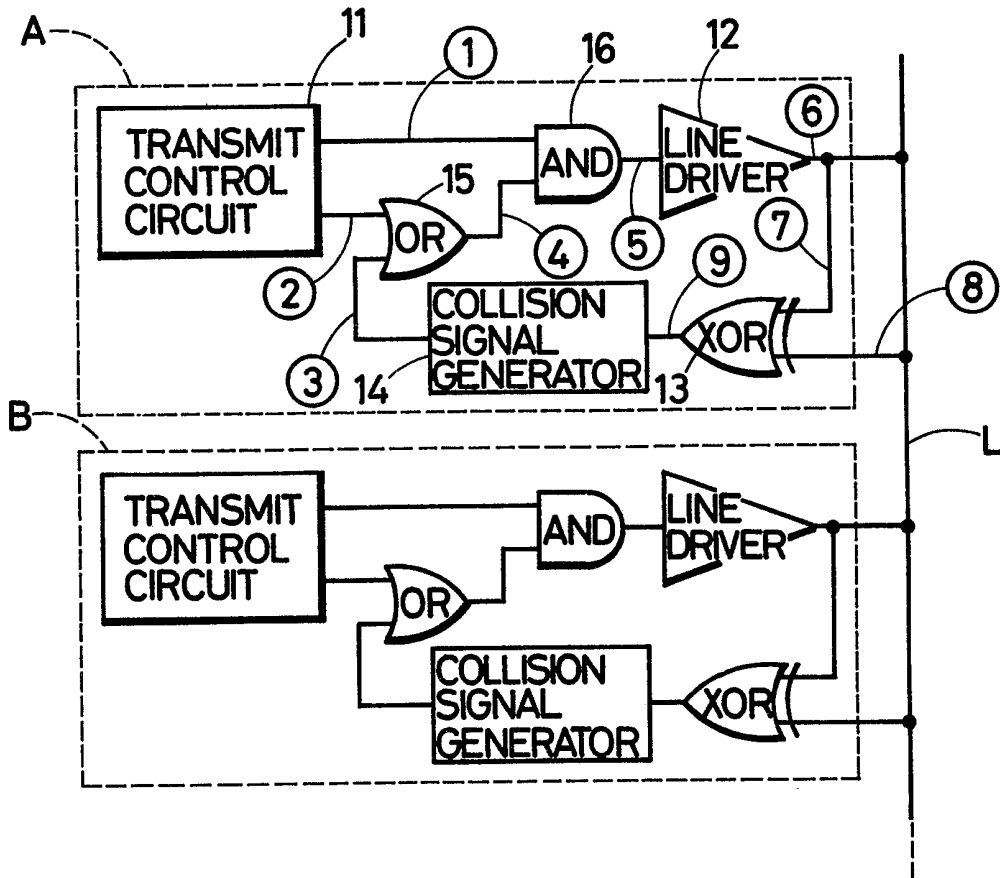


FIG. 3

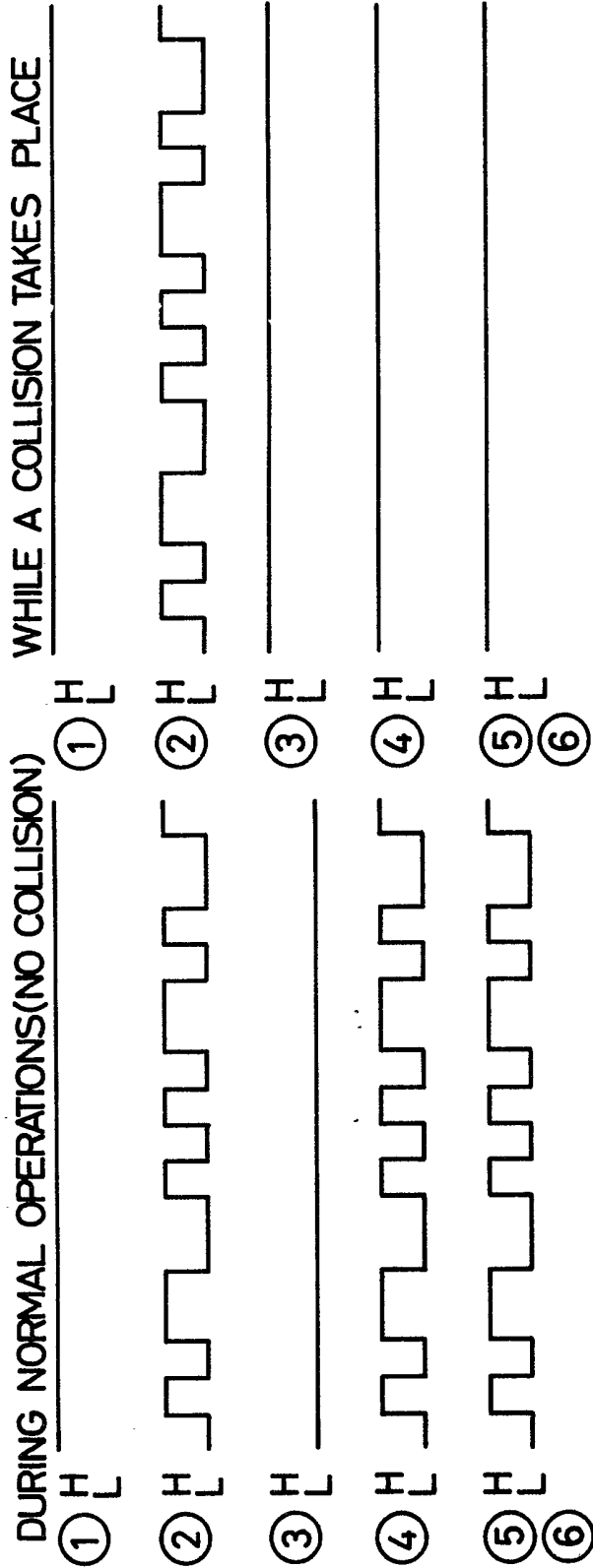
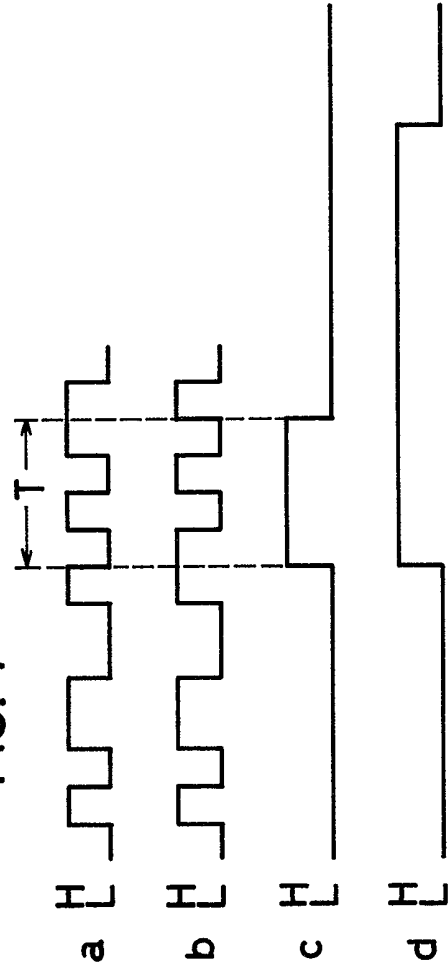


FIG. 4



## SPECIFICATION

### Data transmission system with means for distributing collision signals via the transmission line

#### 5 Background of the Invention

The present invention relates to a data transmission system, more particularly, to a data transmission system capable of transmitting a variety of data between each terminal unit transmitting and receiving such data via a plurality of transmission lines connected thereto.

When a plurality of terminal units are connected to a transmission line while a data transmission is performed between two of them, a certain signal is given to the remaining terminal units, informing them that the data transmission line is engaged, and as a result, except for these two units, no request for using the transmission line can be generated by the remaining units.

Conversely, if a plurality of terminal units simultaneously request for any available transmission line and a permission for using a transmission line is simultaneously given to a plurality of terminal units, it will result in a confusion in transmitting a variety of data, causing them to be incorrectly transmitted. To prevent this, conventional data transmitters apply means, which, on request of any terminal unit for using a transmission line and upon detecting an additional request for any available transmission line from another terminal unit at the same time, allows the controller to output an encoded bit sequence signal so that the terminal unit requesting for the line can detect the presence of such an additional request (hereinafter such a request is referred to as a collision), thus resulting in the improved capability for correctly detecting such a collision in the transmission line. Nevertheless, with any of the conventional data transmitters, a complex circuitry has to be used for properly generating such a bit sequence signal, and in addition, due to a need for providing a software operation circuit, as a whole, such conventional data transmission systems are found disadvantageous for use with their complex structures and due to relatively higher cost.

#### Object and Summary of the Invention

In the light of these disadvantages, the present invention primarily aims at providing a data transmission system capable of unmistakably detecting any possible collision by using a simplified system structure throughout every terminal unit.

Briefly speaking, the present invention provides a data transmission system comprising a plurality of terminal units that can mutually transmit and receive data signals via the transmission line connected, where said data transmission system characteristically comprises the transmission control means outputting a variety of data, means for detecting such a request for any available transmission line, and means for generating a collision signal informing that a plurality of the

terminal units have actually requested for any available transmission line at the same time in vying with others in responding to a request for any available line detected from any other terminal units as soon as such a detecting means has detected such a request.

According to the preferred embodiment of the present invention, as soon as one of the terminal units first detects any collision of request signals, this collision signal is immediately output to the transmission line, thereby enabling all other terminal units to correctly detect such a collision, and as a result, it will result in the improved capability in detecting any collision on the transmission line. Consequently, it minimizes incorrect data transmission.

The preferred embodiment of the present invention eliminates any special circuitry and softwares needed for any of the conventional transmission systems. Using a simplified structure, intended objects can be satisfactorily achieved.

Primary object thus described and other objects of the present invention will be further clarified by the detailed description of the invention in reference to the drawings attached hereto.

#### Brief Description of the Drawings

Figure 1 shows a simplified diagram of a data transmission system as a preferred embodiment of the present invention.

Figure 2 shows a simplified block diagram of the circuitry of terminal units constituting a data transmission system shown in Figure 1.

Figure 3 shows a time chart of the signal levels appearing in respective signals lines of the block diagram shown in Figure 2, representing status during the normal mode and when a collision has taken place, and

Figure 4 also shows a time chart of the signal levels appearing in respective signal lines of the block diagram shown in Figure 2.

#### Detailed Description of the Invention

Figure 1 shows a simplified diagram of a data transmission system as a preferred embodiment of the present invention. A plurality of terminal units A through N each incorporating functions for transmitting and receiving data signals are connected to a transmission line L. Each of these terminal units connected to the transmission line L does not have any unit which is concurrently with a link controller, while such a data transmission system embodied by the present invention is composed so that any data can be transmitted and received by each of these terminal units selected optionally. Figure 2 shows a simplified block diagram of the circuitry of terminals constituting a data transmission system in Figure 1.

As shown in Figure 2, each of the terminal units incorporates the transmission control circuit 11 that outputs all the transmission data, a line driver 12 amplifying all the data signals so that they can be output in an optimum condition, an XOR gate 13 that detects any collision, a collision signal generating circuit 14 that generates a collision

signal in responding to an output from said XOR gate 13 as soon as it detects any collision, and OR gate 15 and an AND gate 16 allowing the output data to be properly output from said transmission control circuit 11 and collision signal generating circuit 14. Figure 3 shows a time chart representing variable signal levels in the signal lines 1 through 6 of the terminal unit A shown in Figure 2. In reference to Figures 2 and 3, operations of the data transmission system embodied by the present invention is described below.

If any desired data should be output from the terminal unit A to the transmission line L, the transmission control circuit 11 in the terminal unit 1 continuously outputs high signals (for example, "1") to one of the terminals of AND gate 16 via the signal line 1, as shown in the normal operation time chart (1) of Figure 3. As a result, AND gate 16 enters an operative condition as soon as the other terminal receives a signal. Next, a transmission line requesting a signal (shown by symbol 2 of the normal operation time chart) representing an address code typical of the terminal unit A is output from the other terminal of the transmission control circuit 11 to one of the input terminals of OR gate 15 via the signal line (2). During this period, as shown in the normal operation time chart (3), the other input terminal of OR gate 15 constantly receives low signals (for example, "0"), whereas a transmission line requesting such a signal characteristic of the terminal unit A is output from OR gate 15 to AND gate 16, as shown in the normal operation time chart (4). Since AND gate 16 constantly receives high signals via the signal line 1 as described earlier, such a transmission line requesting signal fed via the signal line 4 becomes an output signal from AND gate 16. As shown by symbol 5 of the normal operation time chart of Figure 3, such a transmission line requesting signal is output from AND gate 16. This signal is then amplified by the line driver 12 before being sent out to the transmission line L via the signal line 8.

XOR gate 13 provides two input terminals, each of which receives all the transmission line requesting signals sent from the line driver 12 via the signal lines 6 and 7 and also via the transmission line L and the signal line 8, and so all the signals entering XOR gate 13 are the transmission line requesting signals characteristic of the terminal A, whereas all the signals from XOR gate 13 to the signal lines are of the low-level, for example, "0". As a result, no collision signal can be generated by the collision signal generating circuit 14, thus causing only the low-level signal "0" to constantly appear at the signal line 3.

Next, a consideration is given to such a case if both the terminal units A and B simultaneously output a signal requesting for using the transmission line L. Figure 4-a represents a transmission line requesting signal characteristic of the terminal unit A, whereas Figure 4-b represents a transmission line requesting signal

characteristic of the terminal unit B. In this case, the terminal unit A shown in Figure 2 outputs a line requesting signal represented by Figure 4-a, whereas the terminal unit B outputs a line requesting signal represented by Figure 4-b to the transmission line L. Actual indications are found as follows. A transmission line requesting signal typical of the terminal unit A shown in Figure 4-a appears at the signal line 7, which is then fed to one of the terminals of XOR gate 13. Likewise, the other transmission line requesting signal typical of the terminal unit B, which was sent from said terminal unit B to the transmission line L, then appears at the signal line 8, which exactly corresponds to the signal represented by Figure 4-b. This signal is then fed to the other input terminal of XOR Gate 13.

Now, as shown in Figure 4 a and b, said transmission requests signals being characteristic of the terminal units A and B respectively contain such signal component being different from each other during the period T, and as a result, a signal that will become a high signal "1" during said period T appears at the signal output line 9 of XOR gate 13, as shown in Figure 4-c, where said signal line 9 represents Figure 4-a and 4-b as the exclusive logic sum output. In responding to the signal that appeared at the signal line 9, the collision signal generating circuit 14 generates a collision signal for a predetermined period of time as soon as said period T is entered. Such a collision signal will become a high signal "1" for a specific period of time, as shown in Figure 4-d. In other words, a high signal "1" constantly appears at the signal line 3 shown in Figure 2, and as a result, an output from OR gate 15 becomes constant high signals irrelevant of the signal level from the signal line 2, and such high signals are eventually transmitted to the transmission line L via AND gate 16, line driver 12, and the signal line 6.

Time chart shown in Figure 3 represents levels of the collided signals in the signal lines 1 through 6. Signals appearing at transmission line L constantly goes high. Since such a signal appearing at the transmission line L is different in nature from said transmission requesting signals characteristic of these terminal units, these units can effectively detect any collision as can be done so by the terminal unit A. In other words, as soon as transmission line requesting signals have been output simultaneously from a plurality of terminal units, one of these units that has initially detected such a collision then outputs collision detect signals, i.e., constantly high signals to the transmission line. As a result, even if any other terminal unit has erroneously missed such a collision signal due to incompatibility of the line requesting signals sent from respective terminal units, such a terminal unit that has initially detected the collision can effectively output a collision detect signal. Since such a collision signal constantly remains high contrary to the line requesting signals inherent to respective terminal units, all other terminal units can also detect the

collision instantly. Consequently, such an effective system as described above significantly improves an overall collision detection capability throughout the entire data transmission system.

- 5 The present invention thus described in reference to the annexed drawings will obviously be suggestive of any derivation or modification from the spirit and scope contained therein by those skilled in the arts. It should be understood,  
10 however, that the present invention is not limitative of the spirit and scope described above, but is sole inclusive of such derivations and/or modifications within the spirit and scope of the following claims

#### 15 CLAIMS

1. A data transmission system connected to a plurality of terminal units each capable of transmitting and receiving data to and from a  
20 transmission line wherein each of the connected terminal units comprises;  
means for controlling transmission outputting a variety of data;  
means for detecting requests for using a transmission line; and  
25 means for generating a collision signal outputting said signal informing other terminal units of simultaneous requests being made by a

- plurality of terminal units for using any available transmission line as soon as said means for  
30 detecting requests for an available transmission line detects such requests for using an available transmission line made by other terminal units.

2. A data transmission system according to claim 1 wherein said collision signal comprises  
35 continuous signals containing the same level, which can be output for a specific period of time.

3. A data transmission system comprising a plurality of terminals each having means for generating a request for use of a communication channel between terminals, and means responsive  
40 to the concurrent presence of said request and a request from another terminal unit for sending to other terminal units a signal indicating that concurrent communication channel requests have  
45 been made.

4. A system as claimed in claim 3, wherein the generating means of each terminal is arranged to generate a request which is characteristic of that terminal, and wherein said means responsive to  
50 the concurrent presence of requests comprises exclusive-OR gate means for receiving the requests at respective inputs thereof.

5. A data transmission system substantially as herein described with reference to the  
55 accompanying drawings.