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(54) **Connection apparatus**

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Appareil de connexion

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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The invention relates to a connection apparatus, and more particularly to a connection apparatus with high voltage impulse protection.

Description of the Related Art

[0002] Whenever electronic circuitry is coupled to an external cable run there is a risk of damage to the circuit, due to the transmission of transient overvoltages by the cable run. Transient overvoltages may be due to any one of several factors. For example, lightning, electrostatic discharge, or malfunctioning equipment at a remote end of the cable may be responsible. Several techniques exist for isolating circuitry from potentially damaging surges.

[0003] Fig. 1 is a schematic diagram of a conventional network connector. As shown, the network connector 100 provides high voltage impulse protection (also referred to as lightening or surge protection) between signal lines by transient voltage suppressor (TVS) diodes 10A~10D and provides high voltage impulse protection between signal lines and a ground terminal by coupling resistors R1~R4 and a capacitor CH to the pins TX+, TX-, RX+ and RX-.

[0004] The described method, however, has the following disadvantages. Energy caused the high voltage impulse may discharge to other components as the resistors have a large volume. To sustain the discharged energy, however, the volume of the resistors must be sufficiently large. Further, in order provided optimum isolation for a component, isolation glue must be coated on the printed circuit board, reducing yield and increasing time-to-market.

[0005] The currents through the each resistor may also be different due to resistance error in the resistors, such that the resistor with a relative smaller resistance may bear a larger current and thus be damaged. Total cost increases with the total number of resistors used. The resistors may age due to lightening. Additionally, there is no lightening protection for the secondary coils (TL3 and TL4), and thus, interference with the core of the system by lightening is not preventable. Typical integrated circuits are not capable of sustaining high voltage and although the primary coils (TL1 and TL2) isolate most discharged energy, a voltage of several tens of volts is still induced in the secondary coils and the motherboard may be damaged accordingly.

[0006] Document US-B-6541878 discloses a connection apparatus according to the preamble of claim 1.

BRIEF SUMMARY OF THE INVENTION

[0007] A connection apparatus according to claim 1 and a method according to claim 13 provide a solution to the problems posed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The invention can be more fully understood by reading the subsequent detailed description and examples with references made to the accompanying drawings, wherein:

[0009] Fig. 1 is a schematic diagram of a conventional network connector;

[0010] Fig. 2 shows an embodiment of a connection apparatus;

[0011] Fig. 3 is a diagram illustrating high voltage impulse protector and a slot in the connection apparatus;

[0012] Fig. 4 is another diagram illustrating the high voltage impulse protector and the slot in the connection apparatus;

[0013] Fig. 5 is a diagram illustrating a isolation transformer and a transient voltage suppression unit in the connection apparatus;

[0014] Fig. 6 shows another embodiment of a connection apparatus;

[0015] Fig. 7 is a diagram showing the connection apparatus shown in Fig. 6; and

[0016] Figs. 8A and 8B show another embodiment of a connection apparatus.

DETAILED DESCRIPTION OF THE INVENTION

[0017] The following description is of the best-contemplated mode of carrying out the invention. This description is made for the purpose of illustrating the general principles of the invention and should not be taken in a limiting sense. The scope of the invention is best determined by reference to the appended claims.

[0018] In a space with high surface curvature (such as a tip), the surrounding air may be dissociated to generate gas discharge, known as point discharge, when electric field strength increases acutely. The invention utilizes point discharge to discharge energy from high voltage impulse on all pins (connected to the primary coil) to the ground terminal by a capacitor when a high voltage impulse event occurs.

[0019] Fig. 2 shows an embodiment of a connection apparatus. As shown, a connection apparatus 200 comprises a slot 22, two isolation transformers 24A and 24B, a high voltage impulse protector 26 and two transient voltage suppression units 28A and 28B. In this embodiment, the connection apparatus 200 can be a network connector but is not limited thereto.

[0020] The slot 22 is coupled between an external network cable (not shown) and the isolation transformers 24A and 24B and comprises a plurality of pins TX+, TX-, RX+ and RX-. For example, the slot 22 can be disposed on a circuit board 29 (shown in Fig. 3) by dual-in-line package (DIP) technology.

[0021] The isolation transformers 24A and 24B both

comprise a primary coil and a secondary coil, in which the primary coil and the secondary coil each has a first end, a second end and a tap. The primary coils of the isolation transformers 24A and 24B are coupled to the slot 22 respectively, and the secondary coils of the isolation transformers 24A and 24B are coupled to an external processing circuit (not shown), such as a processing circuit on a local area network (LAN) card or a motherboard, through the connection terminals TD+, TD-, RD+ and RD-. For example, the first and second ends of the primary coil in the isolation transformer 24A are coupled to the pins TX+ and TX-, and the first and second ends of the primary coil in the isolation transformer 24B are coupled to the pins RX+ and RX-.

[0022] The high voltage impulse protector 26 is disposed between the primary coils of the isolation transformers 24A and 24B and a ground terminal to discharge overcurrent generated by a high voltage impulse the ground terminal by point discharge when a high voltage impulse event occurs. For example, as shown in Fig. 3, the high voltage impulse protector 26 can be a conductive layer CM with a plurality of tips TP aligning with pins of the slot 22 respectively. The conductive layer CM does not connect to the pins of the slot 22 directly and provides high voltage impulse protection between signal lines and the ground terminal by point discharge only when a high voltage impulse event occurs.

[0023] Namely, when no high voltage impulse event occurs, the high voltage impulse protector 26 and all pins of the slot 22 are not electrically connected, i.e., they are open-circuit. The high voltage impulse protector 26 and the pins of the slot 22 are electrically coupled by point discharge only when a high voltage impulse event occurs. As shown in Fig. 4, the conductive layer CM has a plurality of tips TP separated from pins PN of the slot 22 by a small gap gp, such that the tips TP do not electrically connect directly to the pins PN of the slot 22. Because point discharge is a non-contact design, signals on the pins PN are not affected by aging of the high voltage impulse protector 26 and other elements of the conventional connector can also be prevented. Energy induced by high voltage impulse is discharged to the tips TP by the pins PN connected to the primary coil, electric energy is converted to luminous energy for 0.5-10ns, and after partial decay, is discharged to the ground terminal by the capacitor.

[0024] Because the first end and the second end of the primary coils in the isolation transformers 24A and 24B are electrically coupled to the pins RX+, RX-, TX- and TX+, the high voltage impulse protector 26 discharges an overcurrent caused by a high voltage on the pins RX+, RX-, TX- and TX+ to the ground terminal by point discharge when a high voltage impulse event occurs. Thus, the isolation transformers 24A and 24B and other circuits coupled thereto are protected, against high voltage impulse events.

[0025] Further, the high voltage impulse protector 26 can further comprise a capacitor CH coupled between the conductive layer CM and the ground terminal, buffering energy generated by the high voltage impulse event and extending discharge time such that the generated energy can be decayed and discharged to the ground terminal. For example, the conductive layer CM can be a metal layer, such as a copper (Cu) layer but it is not limited thereto.

[0026] It should be noted that the conductive layer CM shown in Fig. 4 is disposed in the circuit board 29 such that the routing on the circuit board 29 can be simplified, but it is also can be disposed on the top surface TS or bottom surface BS of the circuit board 29.

[0027] In some embodiments, the pins of the slot 22 can be connected to the circuit board 29 by plugs when the slot 22 is disposed on the circuit board 29 by surface mount device (SMD) technology. The tips of the high voltage impulse protector 26 can be aligned with the plugs respectively but are not electrically connected directly, thus, high voltage impulse protection is provided between signal lines and the ground terminal by point discharge only when a high voltage impulse event occurs.

[0028] As shown in Fig. 2, the transient voltage suppression units 28A is disposed between the taps of the primary coils in the isolation transformer 24A and 24B and the transient voltage suppression units 28B is disposed between the taps of the secondary coils in the isolation transformer 24A and 24B, performing a high voltage impulse protection between signal lines. Namely, transient voltage suppression units 28A and 28B can serve as a voltage-current limiting element for clamping the voltage and the current, or both, induced at the primary coil, or the secondary coils of the isolation transformer 24A and 24B.

[0029] For example, the transient voltage suppression units 28A and 28B limit current from pins TX+, TX-, RX+ and RX-, current output from the second ends (TD+, TD-, RD+ and RD=) of the secondary coils, voltages on the pins TX+, TX-, RX+ and RX-, or voltage on the second ends (TD+, TD-, RD+ and RD-) of the secondary coils. Further, the transient voltage suppression units 28A and 28B can comprise series-connected or parallel-connected transient voltage suppressor (TVS) diodes, polydiodes, surge absorbers, varistors, zener diodes or combinations thereof but are not limited thereto.

[0030] Fig. 5 shows a diagram illustrating the isolation transformers and the transient voltage suppression units. As shown, the primary coil of the isolation transformer 24A comprises a winding TL1 coupled to the pin TX+, a winding TL2 coupled to the pin TX-, and a tap TPT1 coupled to the transient voltage suppression unit 28A. The primary coil of the isolation transformer 24B comprises a winding RL1 coupled to the pin RX+, a winding RL2 coupled to the pin RX-, and a tap RPT1 coupled to the transient voltage suppression unit 28A. The secondary coil of the isolation transformer 24A comprises a winding TL3 coupled to the pin TD+, a winding TL4 coupled to the pin TD-, and a tap TPT2 coupled to the transient voltage suppression unit 28B. The secondary coil of the

isolation transformer 24B comprises a winding RL3 coupled to the pin RD+, a winding RL4 coupled to the pin RD-, and a tap RPT2 coupled to the transient voltage suppression unit 28B. In this embodiment, the transient voltage suppression unit 28A and 28B can be transient voltage suppressor (TVS) diodes but it is not limited thereto.

[0031] The taps are typically at zero-voltage under normal operation, such that signals on the pins TX+, RX+, RX-, TX-, TD+, RD+, RD- and TD- are not affected by the stray capacitors of the transient voltage suppression units 28A and 28B coupled to the taps.

[0032] When a voltage difference is induced between two signal lines by a high voltage impulse event, currents I1 and I2 flow to transient voltage suppression unit 28A from the tap TPT1 between the windings TL1 and TL2 and currents I3 and I4 flow to transient voltage suppression unit 28B from the tap TPT2 between the windings RL1 and RTL2. Namely, I = (I1+I2) = - (I3+I4), and thus, if clamp current of the transient voltage suppression unit 28A is controlled, the branch currents on the windings TL1, TL2, RL1 and RL2 can be controlled effectively and induced currents at the secondary coil can also be suppressed. Similarly, the induced currents at the secondary coil can be clamped by the transient voltage suppression unit 28B coupled to the taps TPT2 and TPR2, such that the branch currents on the windings TL3, TL4, RL3 and RL4 can be limited, forming a second-stage high voltage impulse protection.

[0033] Further, when a high voltage impulse event occurs between signal lines and the ground terminal, the transient voltage suppression units 28A and 28B still can limit branch current on each winding or clamp the voltage difference between two taps even if currents or voltages on the pins may be different, such that the circuit board can be protected from the high voltage impulse event.

[0034] The connection apparatus of the invention has the following advantages. The discharge path does not couple to signals on the pins, thus, isolation glue is not required, and routing of the circuit board can be simplified. Particularly, because there is no capacitor and resistor coupled to the signals on the pins directly, i.e., the discharge path does not couple signals on the pins, signal decay does not occur. Thus, the connection apparatus can be applied to all high speed network standards without affecting their transmission.

[0035] Further, because the resistive elements of conventional connection apparatuses are omitted, discharge noise generated by resistive elements can be prevented, protection units or resistors are not damaged by the voltage difference due to errors between resistors, and aging of the resistive elements due to high voltage impulses can also be prevented. Moreover, occupied space on the printed circuit board and time-to-market can be reduced. In addition, because each transient voltage impulse suppression unit is disposed between two taps, each transient voltage impulse suppression unit can protect four signal lines and transient voltage impulse suppression units disposed at the secondary coil further provide second-stage protection for a mother board against high voltage impulse events.

[0036] Fig. 6 shows another embodiment of a connection apparatus. As shown, a connection apparatus 300 comprises a plug 32 and a socket 34. Fig. 7 is another diagram of the connection apparatus shown in Fig. 6. In this embodiment, the connection apparatus 300 can be a network connector but is not limited thereto.

[0037] The plug 32 is coupled to the socket 34 through a cable 36, and the socket 34 comprises the high voltage impulse protector 26 and the slot 22 shown in Fig. 2. The high voltage impulse protector 26 is disposed between the primary coils of the isolation transformers 24A and 24B and a ground terminal to discharge overcurrent generated by a high voltage to the ground terminal by point discharge when a high voltage impulse event occurs. For example, the high voltage impulse protector 26 can be a conductive layer CM with a plurality of tips TP aligning with pins of the slot 22 respectively. Operations of the high voltage impulse protector 26 are similar to those described with reference to Figs. 2~4, thus, further description thereof is omitted for brevity.

[0038] Figs. 8A and 8B show another embodiment of a connection apparatus. As shown, a connection apparatus 400 comprises a slot 22 and a plug 32, a circuit board (not shown) in a housing 42, in which the circuit board comprises the high voltage impulse protector 26 shown in Fig. 2. The slot 22, the plug 32 and the high voltage impulse protection 26 are electrically coupled by the circuit board, and the high voltage impulse protection 26 is disposed between the pins of the slot 22 and the ground terminal, discharging overcurrent generated by high voltage to the ground terminal by point discharge when a high voltage impulse event occurs. For example, the high voltage impulse protector 26 comprises a conductive layer CM with a plurality of tips TP aligning with pins of the slot 22 and a capacitor CH coupled between the conductive layer CM and the ground terminal. Operations of the high voltage impulse protector 26 are similar to those described with reference to Figs. 2~4, thus, further description thereof is omitted for brevity.

Claims

1. A connection apparatus (200), comprising:

first and second isolation transformers (24A & 24B) each comprises a primary coil and a secondary coil, in which the primary coil and the secondary coil each comprises a first end, a tap (TPT1, TPR1, TPT2 or TPR2) and a second end; a slot (22) disposed on a circuit board (29), comprising a plurality of pins (PN) coupling to the first end or the second end of the primary coils of the first and second isolation transformers (24A&24B); and

a first transient voltage suppression unit (28A) disposed between the taps (TPT1 & TPR1) of the primary coils of the first and second isolation transformers **characterized in that** a second transient voltage suppression unit is disposed between the taps (TPT2 & TPR2) of the secondary coils of the first and second isolation transformers (24A & 24B) respectively, clamping the overcurrent and high voltage caused by a high voltage impulse when a high voltage impulse event occurs.

2. The connection apparatus as claimed in claim 1, **characterized in that** the first and second transient voltage suppression units (28A&28B) are connected to the taps (TPT1, TPR1, TPT2, TPR2) of the primary coils and the secondary coils without being powered by a power voltage.

3. The connection apparatus as claimed in claim 1, **characterized in that** the first and second transient voltage suppression units (28A&28B) are connected to the taps (TPT1, TPR1, TPT2, TPR2) of the primary coils and the secondary coils without being connected to a ground voltage.

4. The connection apparatus as claimed in claim 1, **characterized in that** the first and second transient voltage suppression units (28A&28B) are connected to the taps (TPT1, TPR1, TPT2, TPR2) of the primary coils and the secondary coils without being connected to the pins (PN) of the slot (22).

5. The connection apparatus as claimed in claim 1, **characterized in that** the first and second transient voltage suppression units (28A&28B) are connected to the taps (TPT1, TPR1, TPT2, TPR2) of the primary coils and the secondary coils without being connected to the first and second ends of the primary and secondary coils.

6. The connection apparatus as claimed in claim 1, wherein the transient voltage suppression units (28A&28B) clamp currents from the first and second ends of the first and second transient voltage suppression units (28A&28B) and voltages induced by the primary coil and the secondary coil of the first and second transient voltage suppression units (28A&28B).

7. The connection apparatus as claimed in claim 1, **characterized in that** the connection apparatus further comprises:

a high voltage impulse protector (26) disposed between the primary coils of the first and second isolation transformer (24A & 24B) and a ground end, and having a plurality of tips aligning with the pins (PN) of the slot (22) without directly connecting, thereby discharging the overcurrent to the ground end when the high voltage impulse event occurs.

8. The connection apparatus as claimed in claim 7, **characterized in that** the high voltage impulse protector (26) does not electrically couple to the pins (PN) of the slot (22) when no high voltage impulse event occurs and discharges overcurrent caused by the high voltage impulse to the ground terminal by point discharge when occurring the high voltage impulse event.

9. The connection apparatus as claimed in claim 7, **characterized in that** the high voltage impulse protector (26) comprises:

a conductive layer (ML); and
a capacitor (CH) coupled between the conductive layer (ML) and the ground terminal.

10. The connection apparatus as claimed in claim 9, **characterized in that** the conductive layer (CM) is disposed in or on the circuit board (29).

11. The connection apparatus as claimed in claim 1, **characterized in that** the connection apparatus (200) is disposed on a local area network (LAN) card or on a motherboard.

12. The connection apparatus as claimed in claim 1, **characterized in that** the connection apparatus (200) is a network connector.

13. A high voltage impulse protection method for a connection apparatus (200) comprising a slot (22) disposed on a circuit board (29) and the slot (22) had a plurality of pins (PN) and first and second isolation transformers (24A&24B) each comprising a primary coil and a secondary coil, in which the primary coil and the secondary coil each comprises a first end, a tap (TPT1, TPR1, TPT2 or TPR2) and a second end, and the method comprising:

disposing first and second high transient voltage suppression units (28A&28B) between taps (TPT1&TPR1) of the primary coils of the first and second isolation transformers and between taps (TPT2&TPR2) of the secondary coils of the first and second isolation transformers respectively, performing a high voltage impulse protection between signal lines.

14. The method as claimed in claim 13, **characterized in that** the first and second transient voltage suppression units (28A&28B) are connected to the taps (TPT1, TPR1, TPT2, TPR2) of the primary coils and

the secondary coils without being powered by a power voltage.

15. The method as claimed in claim 13, **characterized in that** the first and second transient voltage suppression units (28A&28B) are connected to the taps (TPT1, TPR1, TPT2, TPR2) of the primary coils and the secondary coils without being connected to a ground voltage.

16. The method as claimed in claim 13, **characterized in that** the first and second transient voltage suppression units (28A&28B) are connected to the taps (TPT1, TPR1, TPT2, TPR2) of the primary coils and the secondary coils without being connected to the pins (PN) of the slot (22).

17. The method as claimed in claim 13, **characterized in that** the first and second transient voltage suppression units (28A&28B) are connected to the taps (TPT1, TPR1, TPT2, TPR2) of the primary coils and the secondary coils without being connected to the first and second ends of the primary and secondary coils.

18. The method as claimed in claim 13, **characterized in that** the method further comprising:

disposing a high voltage impulse protector (26) between the pins (PN) of the slot (22) and a ground terminal to discharge an overcurrent caused by a high voltage impulse to the ground terminal by point discharge when a high voltage impulse event occurs, in which the high voltage impulse protector (26) has a plurality of tips (TP) which align with the pins (PN) of the slot (22) without directly connecting.

19. The method as claimed in claim 18, **characterized in that** the high voltage impulse protector comprises a conductive layer having the tips aligning with the pins of the slot.

20. The method as claimed in claim 18, **characterized in that** the method further comprising disposing a capacitor between the conductive layer and the ground terminal.

21. The method as claimed in claim 18, **characterized in that** the conductive layer is disposed in or on the circuit board.

Patentansprüche

1. Verbindungsvorrichtung (200) mit:

einem ersten und einem zweiten Isolationstransformator (24A & 24B), die jeweils eine Primärspule und eine Sekundärspule umfassen, wobei die Primärspule und
die Sekundärspule jeweils ein erstes Ende, einen Abgriff (TPT1, TPR1, TPT2 oder TPR2) und ein zweites Ende umfassen;
einem Steckplatz (22), der an einer Leiterplatte (29) angeordnet ist, mit einer Vielzahl von Stiften (PN), die mit dem ersten Ende oder dem zweiten Ende der Primärspulen des ersten und des zweiten Isolationstransformators (24A & 24B) koppeln; und
einer ersten Stoßspannungs-Unterdrückungseinheit (28A), die zwischen den Abgriffen (TPT1 & TPR1) der Primärspulen des ersten und des zweiten Isolationstransformators angeordnet ist, **dadurch gekennzeichnet, dass** eine zweite Stoßspannungs-Unterdrückungseinheit jeweils zwischen den Abgriffen (TPT2 & TPR2) der Sekundärspulen des ersten und des zweiten Isolationstransformators (24A & 24B) angeordnet ist, welche den Überstrom und die Hochspannung begrenzen, die durch einen Hochspannungsimpuls verursacht werden, wenn ein Hochspannungsimpulsereignis auftritt.

2. Verbindungsvorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** die erste und die zweite Stoßspannungs-Unterdrückungseinheit (28A & 28B) mit den Abgriffen (TPT1, TPR1, TPT2, TPR2) der Primärspulen und der Sekundärspulen verbunden sind, ohne durch eine Versorgungsspannung gespeist zu werden.

3. Verbindungsvorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** die erste und die zweite Stoßspannungs-Unterdrückungseinheit (28A & 28B) mit den Abgriffen (TPT1, TPR1, TPT2, TPR2) der Primärspulen und der Sekundärspulen verbunden sind, ohne mit einer Massespannung verbunden zu sein.

4. Verbindungsvorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** die erste und die zweite Stoßspannungs-Unterdrückungseinheit (28A & 28B) mit den Abgriffen (TPT1, TPR1, TPT2, TPR2) der Primärspulen und der Sekundärspulen verbunden sind, ohne mit den Stiften (PN) des Steckplatzes (22) verbunden zu sein.

5. Verbindungsvorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** die erste und die zweite Stoßspannungs-Unterdrückungseinheit (28A & 28B) mit den Abgriffen (TPT1, TPR1, TPT2, TPR2) der Primärspulen und der Sekundärspulen verbunden sind, ohne mit den ersten und zweiten Enden der Primär- und Sekundärspulen verbunden zu sein.

6. Verbindungsvorrichtung nach Anspruch 1, wobei die Stoßspannungs-Unterdrückungseinheiten (28A & 28B) Ströme von den ersten und zweiten Enden der ersten und der zweiten Stoßspannungs-Unterdrükkungseinheit (28A & 28B) und Spannungen, die durch die Primärspule und die Sekundärspule der ersten und der zweiten Stoßspannungs-Unterdrükkungseinheit (28A & 28B) induziert werden, begrenzen.

7. Verbindungsvorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** die Verbindungsvorrichtung ferner umfasst:

einen Hochspannungsimpulsschutz (26), der zwischen den Primärspulen des ersten und des zweiten Isolationstransformators (24A & 24B) und einem Masseende angeordnet ist und eine Vielzahl von Spitzen aufweist, die sich auf die Stifte (PN) des Steckplatzes (22) ausrichten, ohne direkt zu verbinden, wodurch der Überstrom zum Masseende entladen wird, wenn das Hochspannungsimpulsereignis auftritt.

8. Verbindungsvorrichtung nach Anspruch 7, **dadurch gekennzeichnet, dass** der Hochspannungsimpulsschutz (26) nicht mit den Stiften (PN) des Steckplatzes (22) elektrisch koppelt, wenn kein Hochspannungsimpulsereignis auftritt, und den Überstrom, der durch den Hochspannungsimpuls verursacht wird, zum Masseanschluss durch Spitzenentladung entlädt, wenn das Hochspannungsimpulsereignis auftritt.

9. Verbindungsvorrichtung nach Anspruch 7, **dadurch gekennzeichnet, dass** der Hochspannungsimpulsschutz (26) umfasst:

eine leitende Schicht (ML); und
einen Kondensator (CH), der zwischen die leitende Schicht (ML) und den Masseanschluss gekoppelt ist.

10. Verbindungsvorrichtung nach Anspruch 9, **dadurch gekennzeichnet, dass** die leitende Schicht (CM) in oder auf der Leiterplatte (29) angeordnet ist.

11. Verbindungsvorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** die Verbindungsvorrichtung (200) auf einer Karte eines lokalen Netzwerks (LAN) oder auf einer Hauptplatine angeordnet ist.

12. Verbindungsvorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** die Verbindungsvorrichtung (200) ein Netzwerkverbindungsstecker ist.

13. Hochspannungsimpuls-Schutzverfahren für eine Verbindungsvorrichtung (200) mit einem Steckplatz (22), der an einer Leiterplatte (29) angeordnet ist, und wobei der Steckplatz (22) eine Vielzahl von Stiften (PN) aufweist, und einem ersten und einem zweiten Isolationstransformator (24A & 24B) mit jeweils einer Primärspule und einer Sekundärspule, wobei die Primärspule und die Sekundärspule jeweils ein erstes Ende, einen Abgriff (TPT1, TPR1, TPT2 oder TPR2) und ein zweites Ende umfassen und das Verfahren umfasst:

Anordnen einer ersten und einer zweiten Stoßhochspannungs- Unterdrückungseinheit (28A & 28B) zwischen den Abgriffen (TPT1 & TPR1) der Primärspulen des ersten und des zweiten Isolationstransformators bzw. zwischen den Abgriffen (TPT2 & TPR2) der Sekundärspulen des ersten und des zweiten Isolationstransformators, wobei ein Hochspannungsimpulsschutz zwischen Signalleitungen durchgeführt wird.

14. Verfahren nach Anspruch 13, **dadurch gekennzeichnet, dass** die erste und die zweite Stoßspannungs-Unterdrückungseinheit (28A & 28B) mit den Abgriffen (TPT1, TPR1, TPT2, TPR2) der Primärspulen und der Sekundärspulen verbunden sind, ohne durch eine Versorgungsspannung gespeist zu werden.

15. Verfahren nach Anspruch 13, **dadurch gekennzeichnet, dass** die erste und die zweite Stoßspannungs-Unterdrückungseinheit (28A & 28B) mit den Abgriffen (TPT1, TPR1, TPT2, TPR2) der Primärspulen und der Sekundärspulen verbunden sind, ohne mit einer Massespannung verbunden zu sein.

16. Verfahren nach Anspruch 13, **dadurch gekennzeichnet, dass** die erste und die zweite Stoßspannungs-Unterdrückungseinheit (28A & 28B) mit den Abgriffen (TPT1, TPR1, TPT2, TPR2) der Primärspulen und der Sekundärspulen verbunden sind, ohne mit den Stiften (PN) des Steckplatzes (22) verbunden zu sein.

17. Verfahren nach Anspruch 13, **dadurch gekennzeichnet, dass** die erste und die zweite Stoßspannungs-Unterdrückungseinheit (28A & 28B) mit den Abgriffen (TPT1, TPR1, TPT2, TPR2) der Primärspulen und der Sekundärspulen verbunden sind, ohne mit den ersten und zweiten Enden der Primär- und Sekundärspulen verbunden zu sein.

18. Verfahren nach Anspruch 13, **dadurch gekennzeichnet, dass** das Verfahren ferner umfasst:

Anordnen eines Hochspannungsimpulsschutzes (26) zwischen den Stiften (PN) des Steckplatzes (22) und einem Masseanschluss, um ei-

nen Überstrom, der durch einen Hochspannungsimpuls verursacht wird, zum Masseanschluss durch Spitzenentladung zu entladen, wenn ein Hochspannungsimpulsereignis auftritt, wobei der Hochspannungsimpulsschutz (26) eine Vielzahl von Spitzen (TP) aufweist, die sich auf die Stifte (PN) des Steckplatzes (22) ausrichten, ohne direkt zu verbinden.

19. Verfahren nach Anspruch 18, **dadurch gekennzeichnet, dass** der Hochspannungsimpulsschutz eine leitende Schicht mit den Spitzen, die sich auf die Stifte des Steckplatzes ausrichten, umfasst.

20. Verfahren nach Anspruch 18, **dadurch gekennzeichnet, dass** das Verfahren ferner das Anordnen eines Kondensators zwischen der leitenden Schicht und dem Masseanschluss umfasst.

21. Verfahren nach Anspruch 18, **dadurch gekennzeichnet, dass** die leitende Schicht in oder auf der Leiterplatte angeordnet ist.

Revendications

1. Dispositif de couplage (200), comprenant :

un premier et second transformateurs d'isolement (24A, 24B) comprenant chacun une bobine primaire et une bobine secondaire, dans lequel la bobine primaire et la bobine secondaire comprennent chacune une première borne, un piquage (TPT1, TPR1, TPT2 ou TPR2) et une seconde borne ;
un connecteur (22) disposée sur un circuit imprimé (29), comprenant une pluralité de broches (PN) assurant le couplage avec la première borne ou la seconde borne des bobines primaires des premier et second transformateurs d'isolement (24A, 24B) ; et
une première unité de suppression de tension transitoire (28A) disposée entre les piquages (TPT1, TPR1) des bobines primaires des premier et second transformateurs d'isolement, **caractérisé en ce qu'**une seconde unité de suppression de tension transitoire est agencée entre les piquages (TPT2, TPR2) des bobines secondaires respectivement des premier et second transformateurs d'isolement (24A, 24B), bloquant la surintensité et la haute tension provoquées par une impulsion à haute tension lorsqu'un événement impulsionnel à haute tension se produit.

2. Dispositif de couplage selon la revendication 1, **caractérisé en ce que** les première et seconde unités de suppression de tension transitoire (28A, 28B) sont raccordées aux piquages (TPT1, TPR1, TPT2, TPR2) des bobines primaires et des bobines secondaires sans être alimentées par une source de tension.

3. Dispositif de couplage selon la revendication 1, **caractérisé en ce que** les première et seconde unités de suppression de tension transitoire (28A, 28B) sont raccordées aux piquages (TPT1, TPR1, TPT2, TPR2) des bobines primaires et des bobines secondaires sans être raccordées à une tension de masse.

4. Dispositif de couplage selon la revendication 1, **caractérisé en ce que** les première et seconde unités de suppression de tension transitoire (28A, 28B) sont raccordées aux piquages (TPT1, TPR1, TPT2, TPR2) des bobines primaires et des bobines secondaires sans être raccordées aux broches (PN) du connecteur (22).

5. Dispositif de couplage selon la revendication 1, **caractérisé en ce que** les première et seconde unités de suppression de tension transitoire (28A, 28B) sont raccordées aux piquages (TPT1, TPR1, TPT2, TPR2) des bobines primaires et des bobines secondaires sans être raccordées aux première et seconde bornes des bobines primaires et secondaires.

6. Dispositif de couplage selon la revendication 1, dans lequel les unités de suppression de tension transitoire (28A, 28B) bloquent des courants à partir des première et seconde bornes des première et seconde unités de suppression de tension transitoire (28A, 28B) et des tensions induites par la bobine primaire et la bobine secondaire des première et seconde unités de suppression de tension transitoire (28A, 28B).

7. Dispositif de couplage selon la revendication 1, **caractérisé en ce que** le dispositif de couplage comprend, en outre :

un élément de protection par rapport à des impulsions à haute tension (26) disposé entre les bobines primaires des premier et second transformateurs d'isolement (24A, 24B) et une borne de masse, et comportant une pluralité de pointes dans l'alignement des broches (PN) du connecteur (22) sans liaison directe, déchargeant ainsi la surintensité vers la borne de masse lorsque l'événement impulsionnel à haute tension se produit.

8. Dispositif de couplage selon la revendication 7, **caractérisé en ce que** l'élément de protection par rapport à des impulsions à haute tension (26) n'est pas couplé électriquement aux broches (PN) du connecteur (22) lorsqu'aucun événement impulsionnel à

haute tension ne se produit et décharge la surintensité provoquée par l'impulsion à haute tension vers la borne de masse par décharge ponctuelle lorsque se produit l'événement impulsionnel à haute tension.

9. Dispositif de couplage selon la revendication 7, **caractérisé en ce que** l'élément de protection par rapport à des impulsions à haute tension (26) comprend :

une couche conductrice (ML) ; et
un condensateur (CH) couplé entre la couche conductrice (ML) et la borne de masse.

10. Dispositif de couplage selon la revendication 9, **caractérisé en ce que** la couche conductrice (CM) est disposée dans ou sur le circuit imprimé (29).

11. Dispositif de couplage selon la revendication 1, **caractérisé en ce que** le dispositif de couplage (200) est disposé sur une carte de réseau local (LAN) ou sur une carte mère.

12. Dispositif de couplage selon la revendication 1, **caractérisé en ce que** le dispositif de couplage (200) est un connecteur de réseau.

13. Procédé de protection par rapport à des impulsions à haute tension pour un dispositif de couplage (200) comprenant un connecteur (22) disposé sur un circuit imprimé (29), le connecteur (22) comportant une pluralité de broches (PN) et des premier et second transformateurs d'isolement (24A, 24B) chacun comprenant une bobine primaire et une bobine secondaire, dans lequel la bobine primaire et la bobine secondaire comprennent chacune une première borne, un piquage (TPT1, TPR1, TPT2 ou TPR2) et une seconde borne, le procédé comprenant :

la mise en place de première et seconde unités de suppression de haute tension transitoire (28A, 28B) respectivement entre des piquages (TPT1, TPR1) des bobines primaires des premier et second transformateurs d'isolement et entre des piquages (TPT2, TPR2) des bobines secondaires des premier et second transformateurs d'isolement, assurant une protection par rapport à des impulsions à haute tension entre les lignes.

14. Procédé selon la revendication 13, **caractérisé en ce que** les première et seconde unités de suppression de tension transitoire (28A, 28B) sont raccordées aux piquages (TPT1, TPR1, TPT2, TPR2) des bobines primaires et des bobines secondaires sans être alimentées par une source de tension.

15. Procédé selon la revendication 13, **caractérisé en ce que** les première et seconde unités de suppression de tension transitoire (28A, 28B) sont raccordées aux piquages (TPT1, TPR1, TPT2, TPR2) des bobines primaires et des bobines secondaires sans être raccordées à une tension de masse.

16. Procédé selon la revendication 13, **caractérisé en ce que** les première et seconde unités de suppression de tension transitoire (28A, 28B) sont raccordées aux piquages (TPT1, TPR1, TPT2, TPR2) des bobines primaires et des bobines secondaires sans être raccordées aux broches (PN) du connecteur (22).

17. Procédé selon la revendication 13, **caractérisé en ce que** les première et seconde unités de suppression de tension transitoire (28A, 28B) sont raccordées aux piquages (TPT1, TPR1, TPT2, TPR2) des bobines primaires et des bobines secondaires sans être raccordées aux première et seconde bornes des bobines primaires et secondaires.

18. Procédé selon la revendication 13, **caractérisé en ce que** le procédé comprend, en outre :

la mise en place d'un élément de protection par rapport à des impulsions à haute tension (26) entre les broches (PN) du connecteur (22) et une borne de masse afin de décharger une surintensité provoquée par une impulsion à haute tension vers la borne de masse par décharge ponctuelle lorsqu'un événement impulsionnel à haute tension se produit, dans lequel l'élément de protection par rapport à des impulsions à haute tension (26) comporte une pluralité de pointes (TP) qui sont alignées avec les broches (PN) du connecteur (22) sans liaison directe.

19. Procédé selon la revendication 18, **caractérisé en ce que** l'élément de protection par rapport à des impulsions à haute tension comprend une couche conductrice comportant les pointes alignées avec les broches du connecteur.

20. Procédé selon la revendication 18, **caractérisé en ce que** le procédé comprend, en outre, l'agencement d'un condensateur entre la couche conductrice et la borne de masse.

21. Procédé selon la revendication 18, **caractérisé en ce que** la couche conductrice est disposée dans ou sur le circuit imprimé.

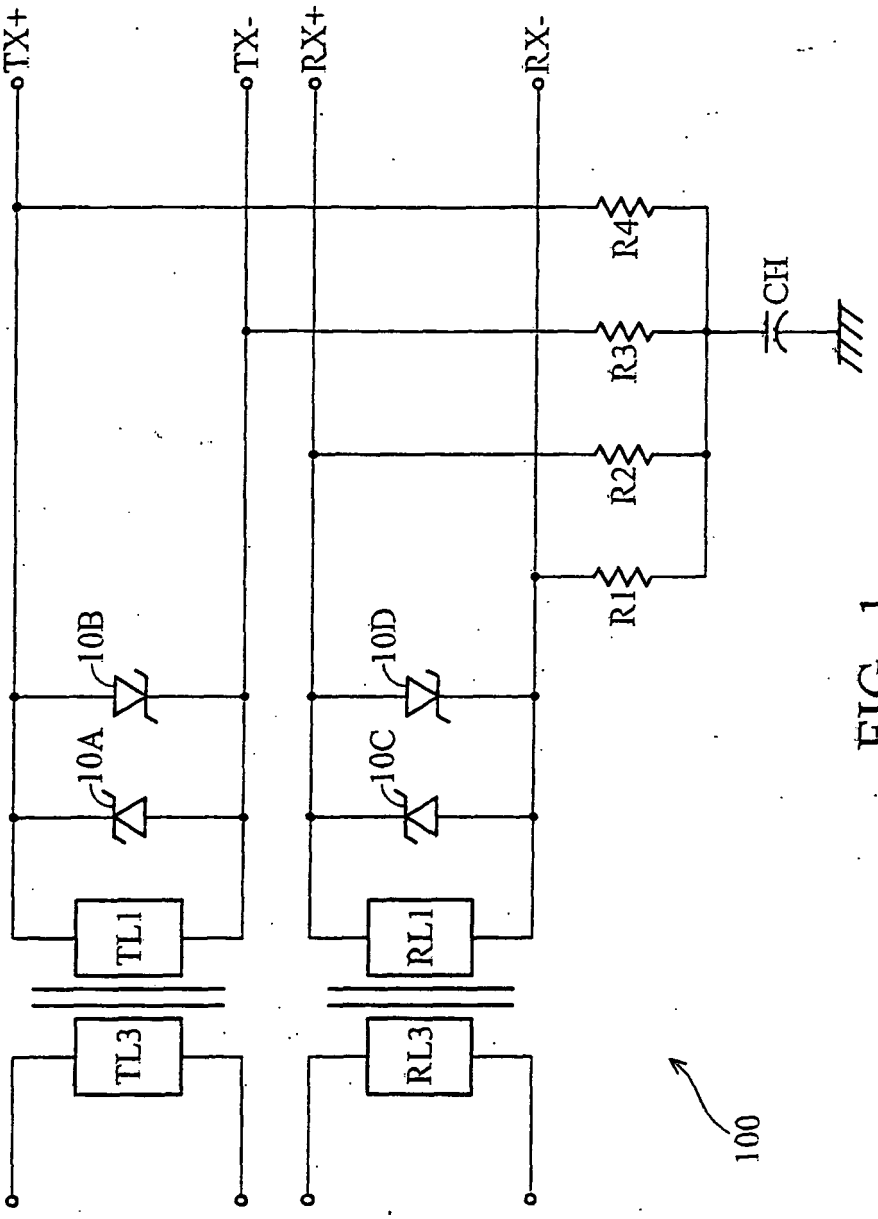


FIG. 1

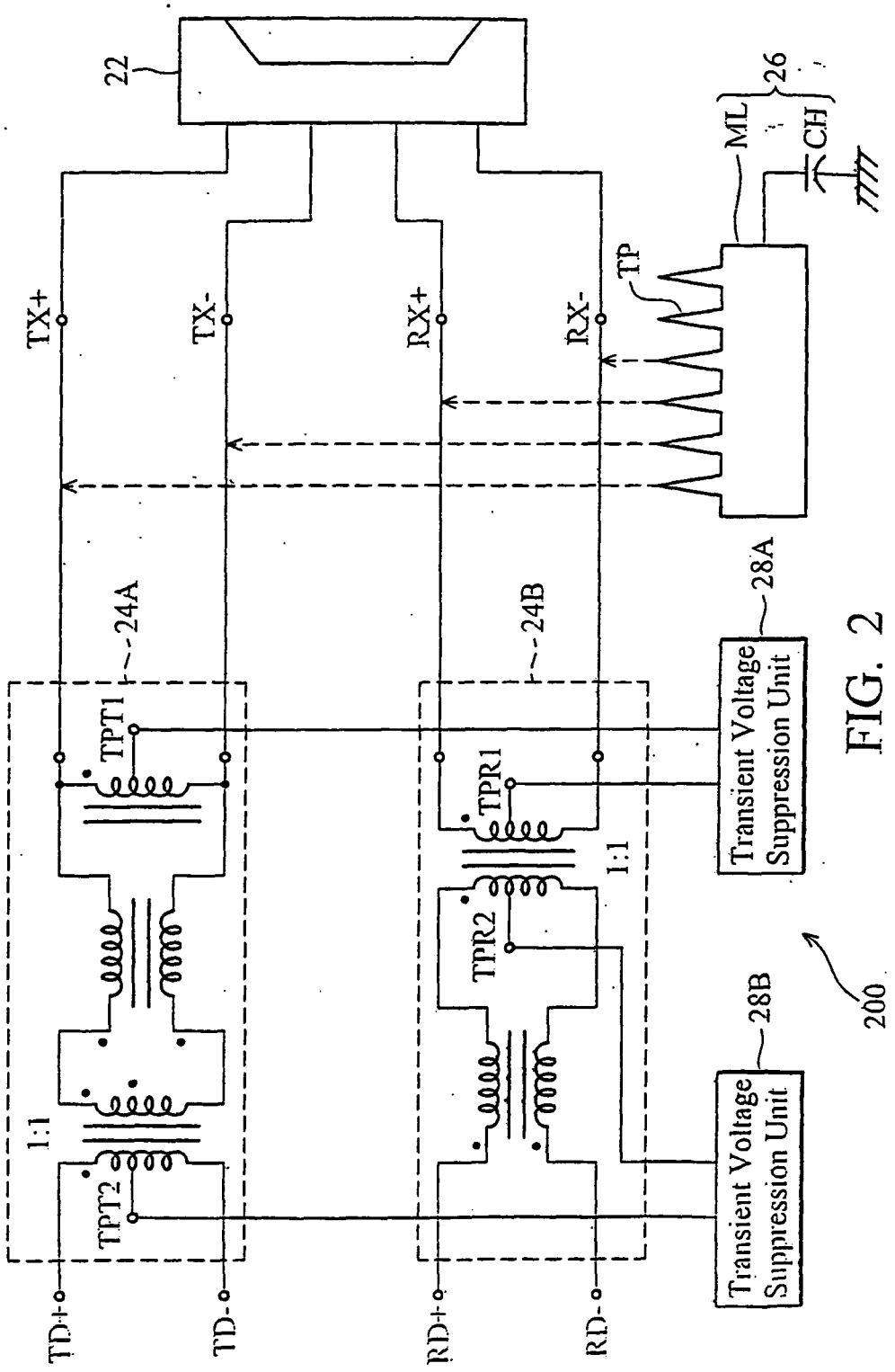

22
26
ML
CH
TX+
TX-
RX+
RX-
TP
24A
24B
28A
28B
TPT1
TPT2
TPR1
TPR2
1:1
1:1
Transient Voltage Suppression Unit
Transient Voltage Suppression Unit
200
TD+
TD-
RD+
RD-

FIG. 2

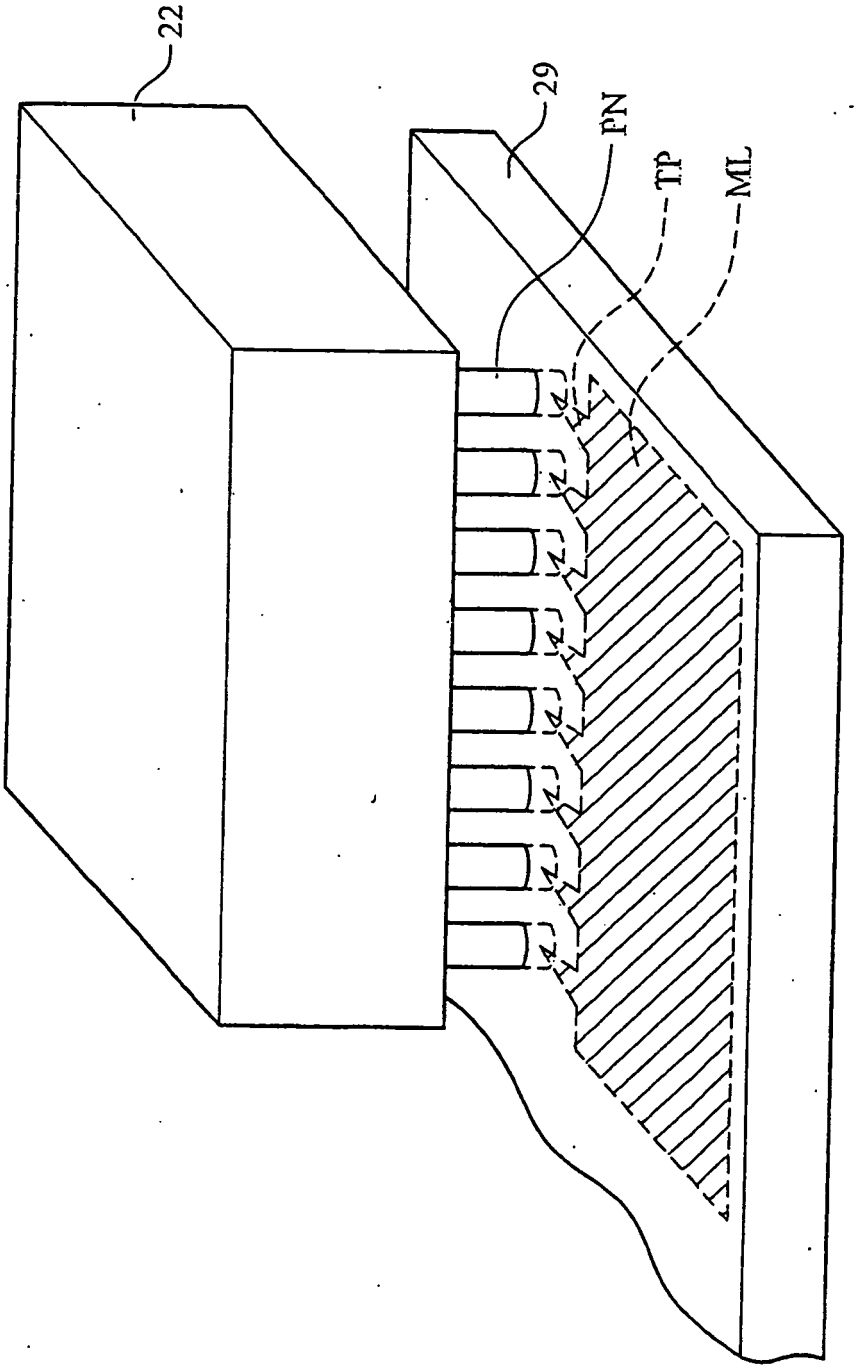


FIG. 3

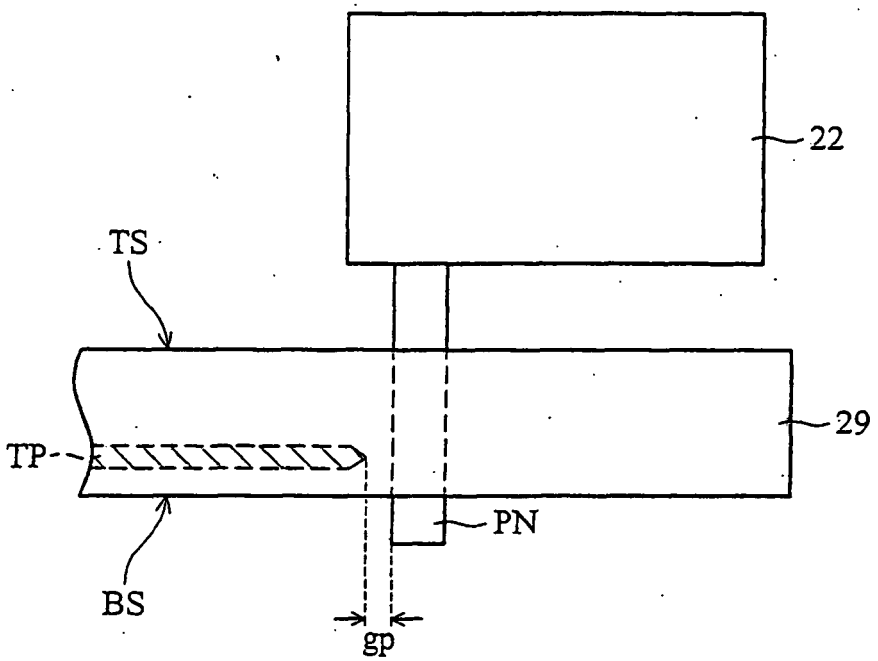


FIG. 4

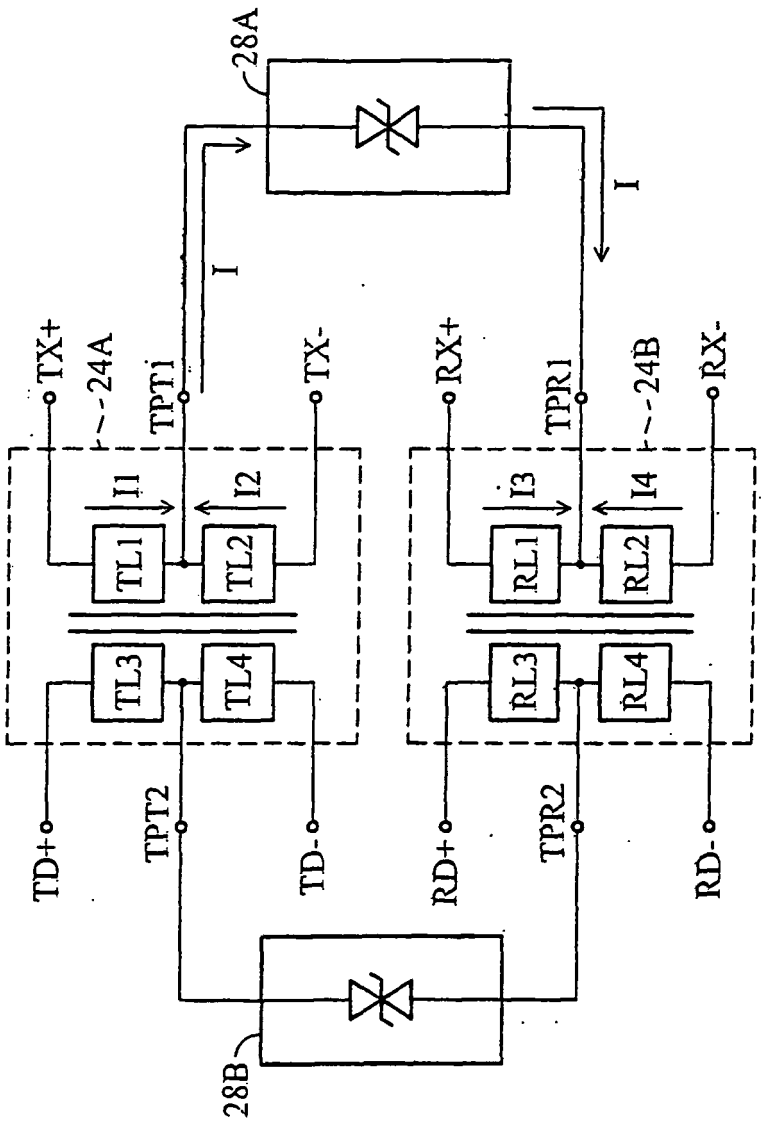

28A
I
I
TX+
24A
TPT1
TX-
RX+
TPR1
24B
RX-
I1
I2
I3
I4
TL1
TL2
RL1
RL2
TL3
TL4
RL3
RL4
TD+
TPT2
TD-
RD+
TPR2
RD-
28B

FIG. 5

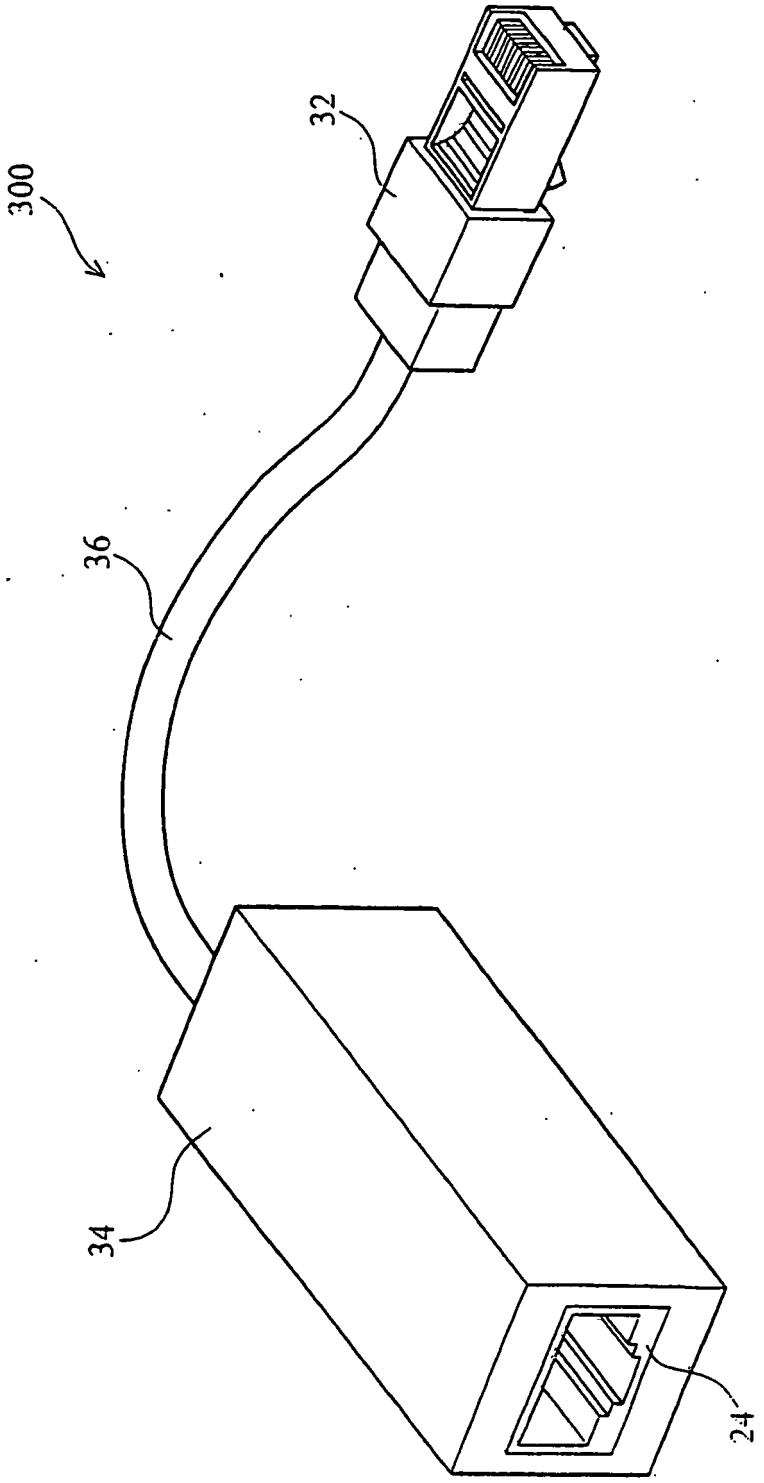


FIG. 6

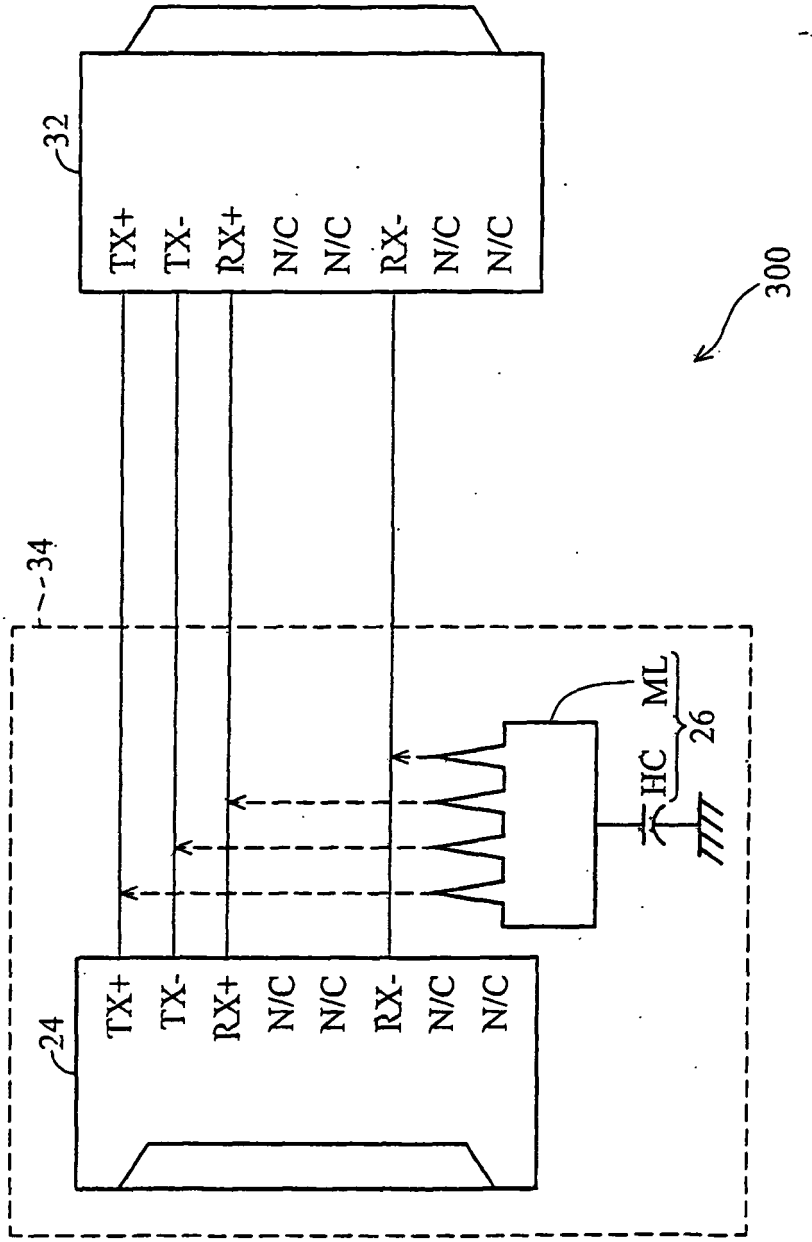


FIG. 7

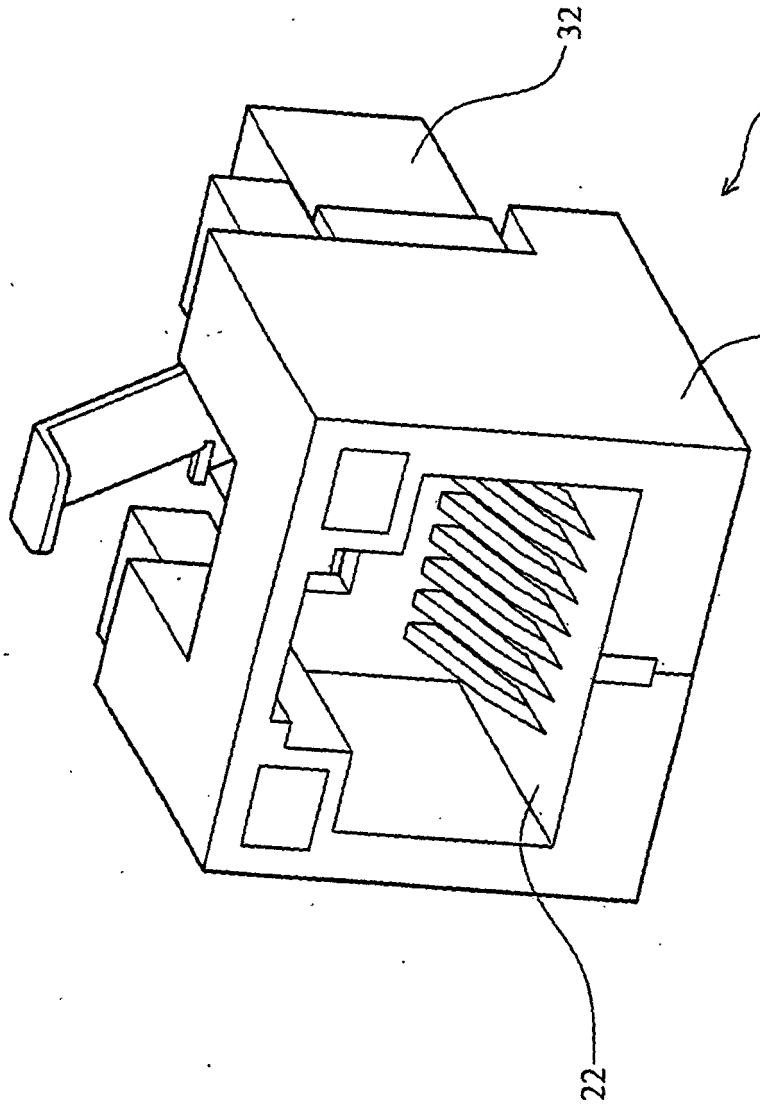


FIG. 8A

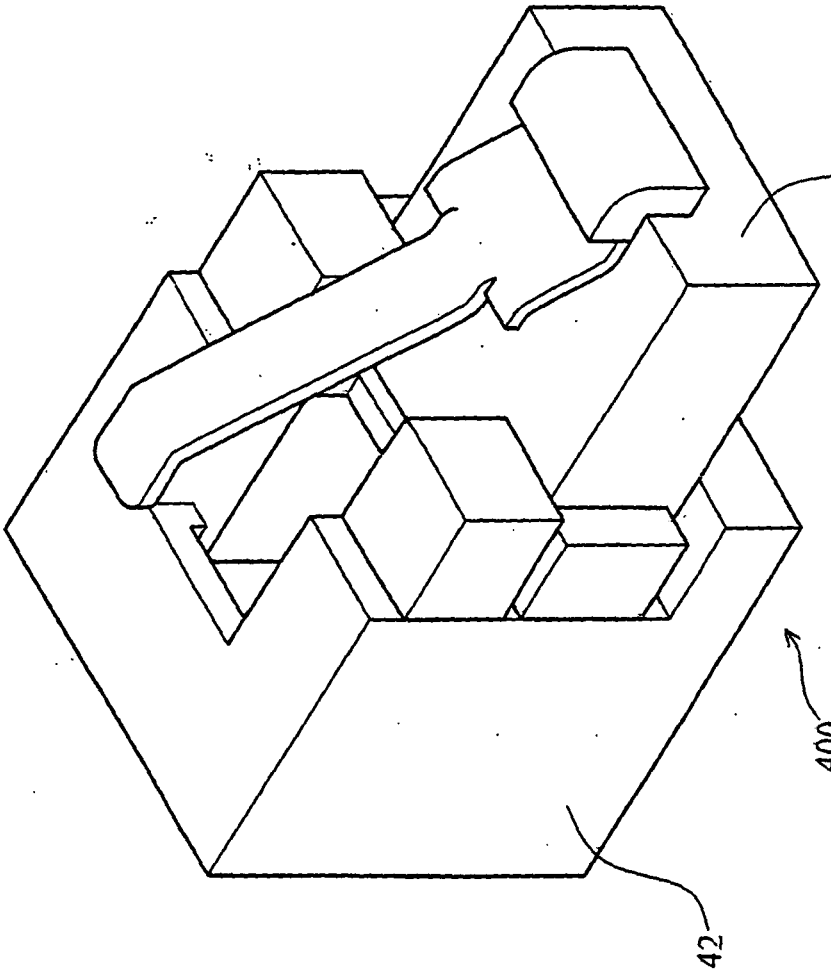


FIG. 8B

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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