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Cox et al.

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- (54) **APPARATUS AND METHOD FOR PROVIDING T1/E1 TELECOMMUNICATIONS TRUNKS OVER IP NETWORKS**
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- (73) Assignee: **Toledo Communications, Inc.**, Austin, TX (US)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

6,298,043 B1 * 10/2001 Mauger et al. 370/248

FOREIGN PATENT DOCUMENTS

EP 1 026 848 A2 3/2000
WO PCT/US98/24290 5/1999

OTHER PUBLICATIONS

Ramnath A. Lakshmi-Ratan, XP-000851517, The Lucent Technologies Softswitch—Realizing The Promise Of Convergence, Apr. 2, 1999, p. 176, col. 2, line 10—p. 181, col. 2, line 16.
Raffaele Noro, XP-000991295, “Circuit Emulation Over IP Networks”, Aug. 25, 1999, pp. 187–201.
Shaul Berger, XP-000992213, “Implement A Single-Chip, Multichannel VoIP DSP Engine”, May 25, 2000, pp. 101–105.

* cited by examiner

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- (51) **Int. Cl.**⁷ **H04J 3/02**; H04L 12/66
- (52) **U.S. Cl.** **370/537**; 370/463; 370/465; 370/466
- (58) **Field of Search** 370/352, 353, 370/389, 390, 392, 401, 412, 420, 422, 463, 465, 466, 467, 470, 471, 474, 537

(57) **ABSTRACT**

An apparatus and method are provided that enable T1 (or E1) telecommunications frames to be transmitted between T1 (or E1) telecommunications switches over a high bandwidth packet-switched network. The apparatus includes trunk interface logic and network translation logic. The trunk interface logic is coupled a central office switch via a central office switch trunk, and receives the telecommunications frames from the central office switch. The network translation logic is coupled to the trunk interface logic. The network translation logic translates the telecommunications frames into network packets that the telecommunications frame data may be transferred over the high bandwidth packet-switched network.

(56) **References Cited**
U.S. PATENT DOCUMENTS

4,740,955	A	*	4/1988	Litterer et al.	370/264
5,426,637	A	*	6/1995	Derby et al.	370/401
5,440,616	A	*	8/1995	Harrington et al.	379/88
5,682,386	A	*	10/1997	Arimilli et al.	370/468
5,892,764	A	*	4/1999	Riemann et al.	370/401
5,910,946	A	*	6/1999	Csapo	370/328
6,044,080	A	*	3/2000	Antonov	370/401
6,064,653	A	*	5/2000	Farris	370/237
6,069,890	A	*	5/2000	White et al.	370/352
6,219,348	B1	*	4/2001	Allen, Jr. et al.	370/354

40 Claims, 8 Drawing Sheets

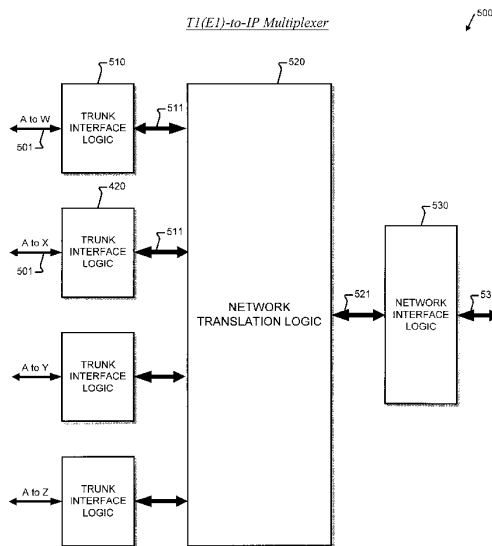


FIG. 1 (Related Art)

Public Switched Telephone Network (PSTN) Interconnectivity

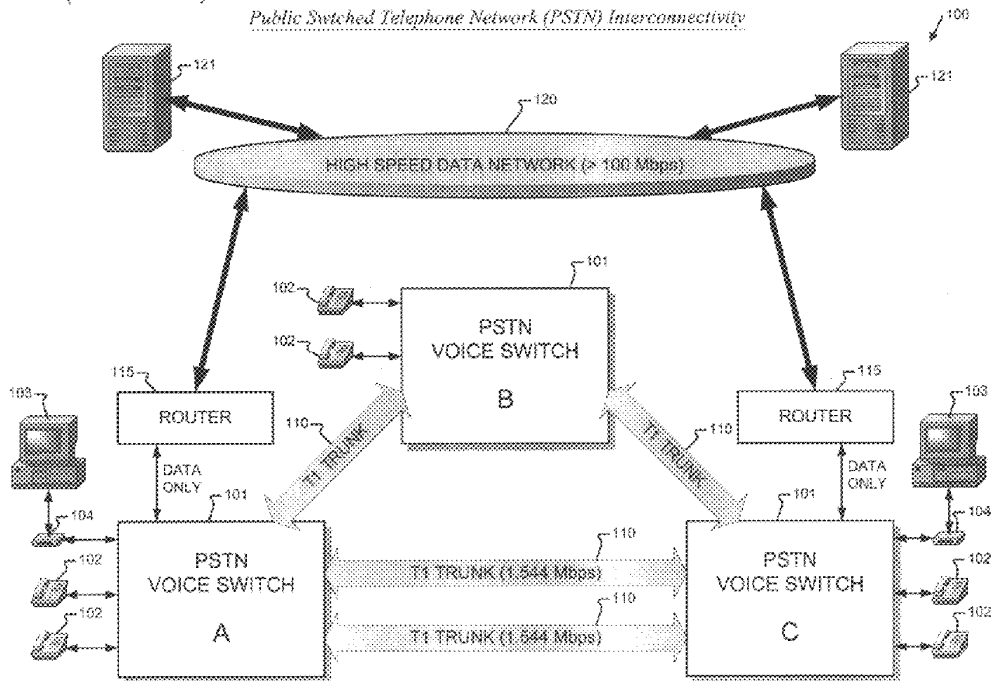


FIG. 2 (Related Art)

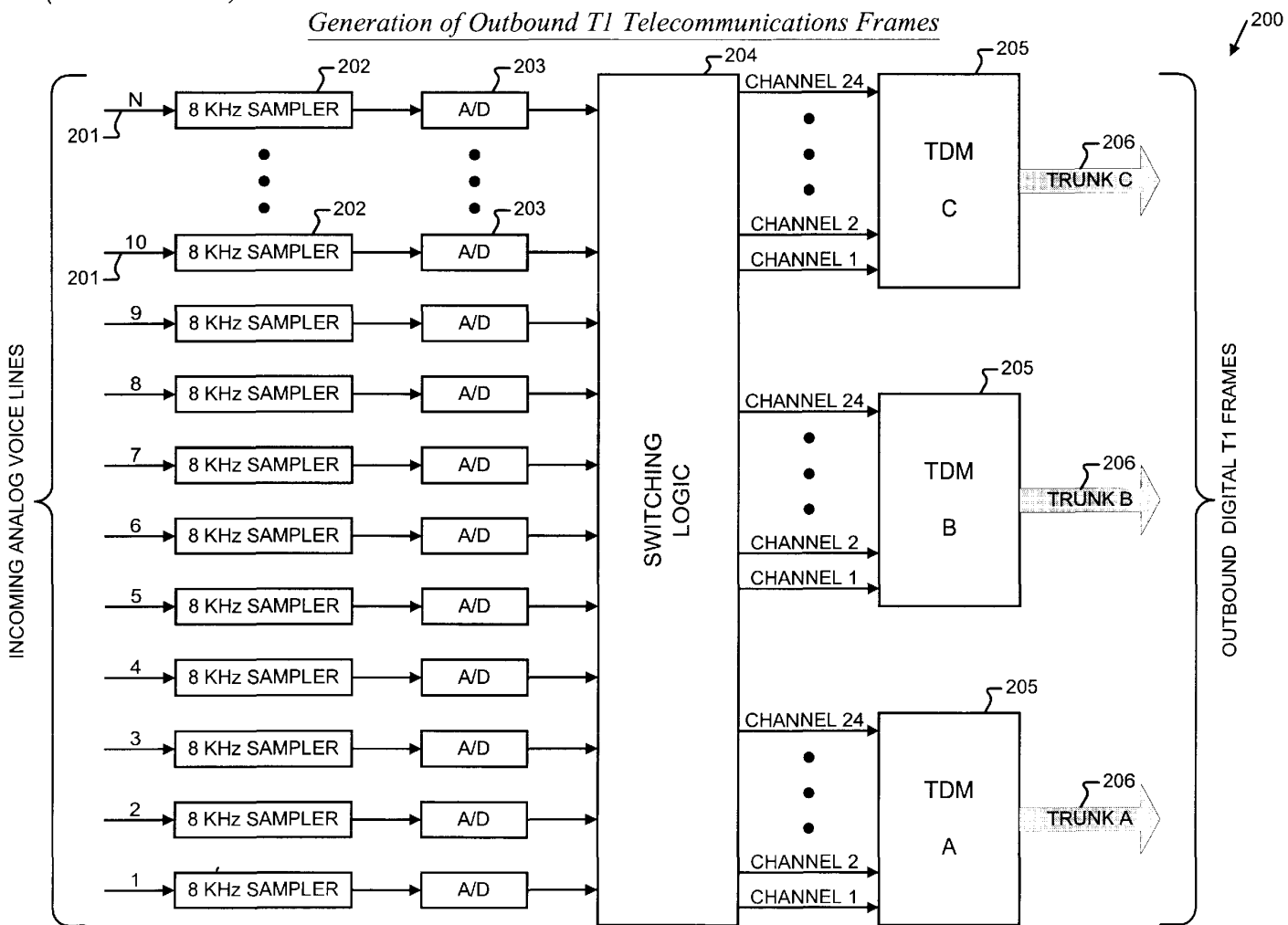


FIG. 3

E1 Continuous Carrier Transmission versus Packet-Switched Network Transmissions

300

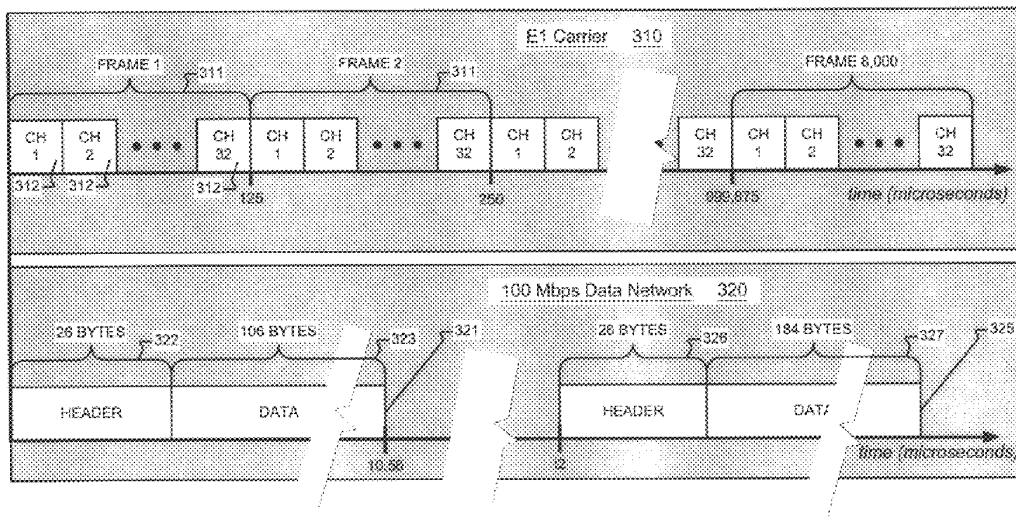
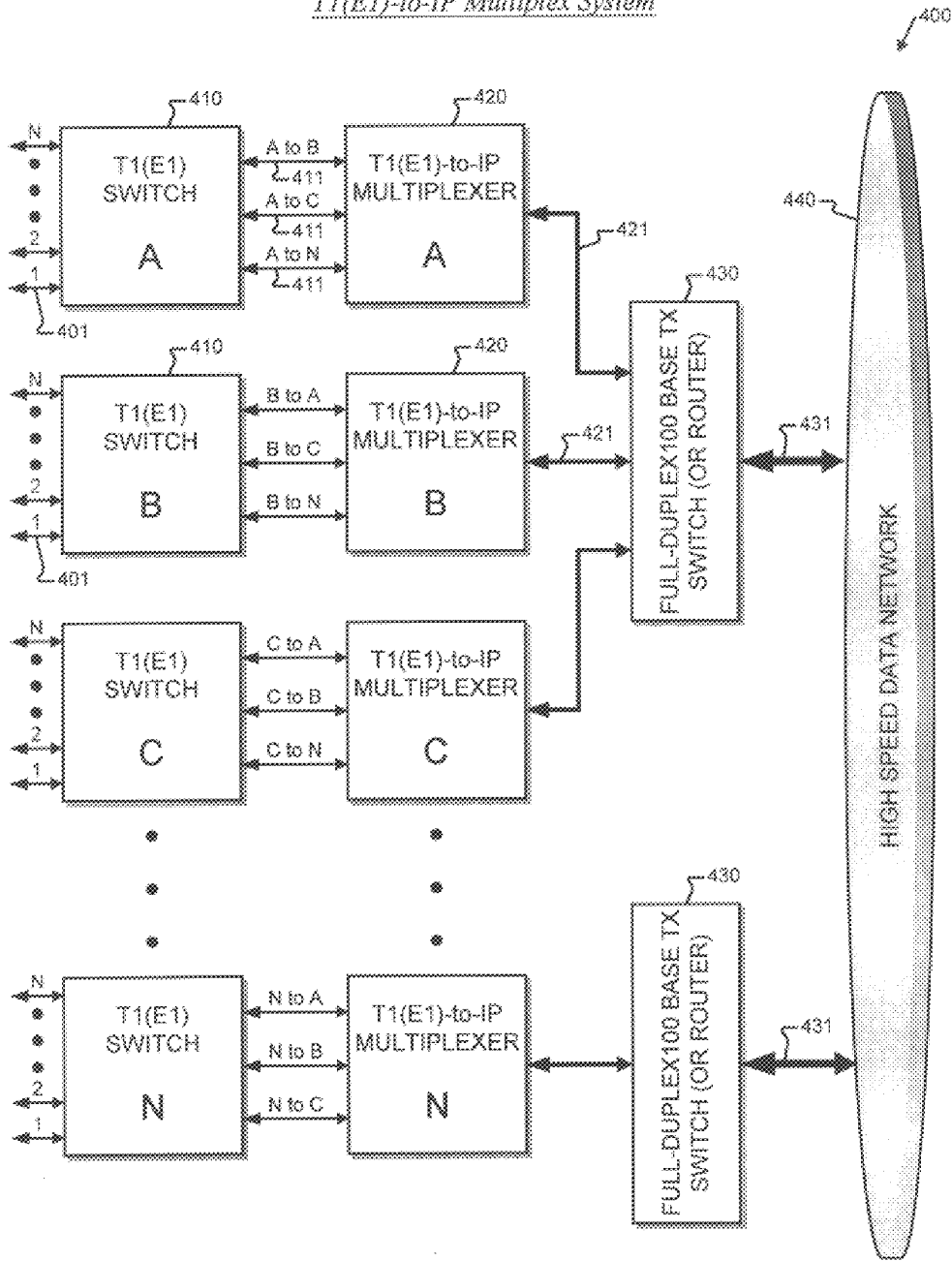


FIG. 4

T1(E1)-to-IP Multiplex System



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