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(54) **SUPERVISION CONTROL SYSTEM**

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(*) Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

(21) Appl. No.: **08/810,977**

(22) Filed: **Feb. 27, 1997**

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Issued: **Feb. 28, 1995**
Appl. No.: **08/261,890**
Filed: **Jun. 17, 1994**

U.S. Applications:

(63) Continuation of application No. 07/780,121, filed on Oct. 19, 1991, now abandoned.

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(51) **Int. Cl.**[7] **H04J 3/14**

(52) **U.S. Cl.** **370/236**; 370/399

(58) **Field of Search** 370/229, 230, 370/231, 232, 233, 234, 235, 238, 395, 389, 468, 431, 447, 449, 455, 461, 462, 477, 471, 444, 443, 442, 428, 411, 412–418; 340/825.5, 825.51, 825.52

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(57) **ABSTRACT**

A supervision control system for an ATM cell switching system counts the number of cells transmitted from a subscriber in a predetermined duration unit, attaches a sign to the cells when the counted value exceeds a predetermined value, and discards the cells to which the sign is attached when a buffer does not have enough capacity during a cell multiplexation.

98 Claims, 8 Drawing Sheets

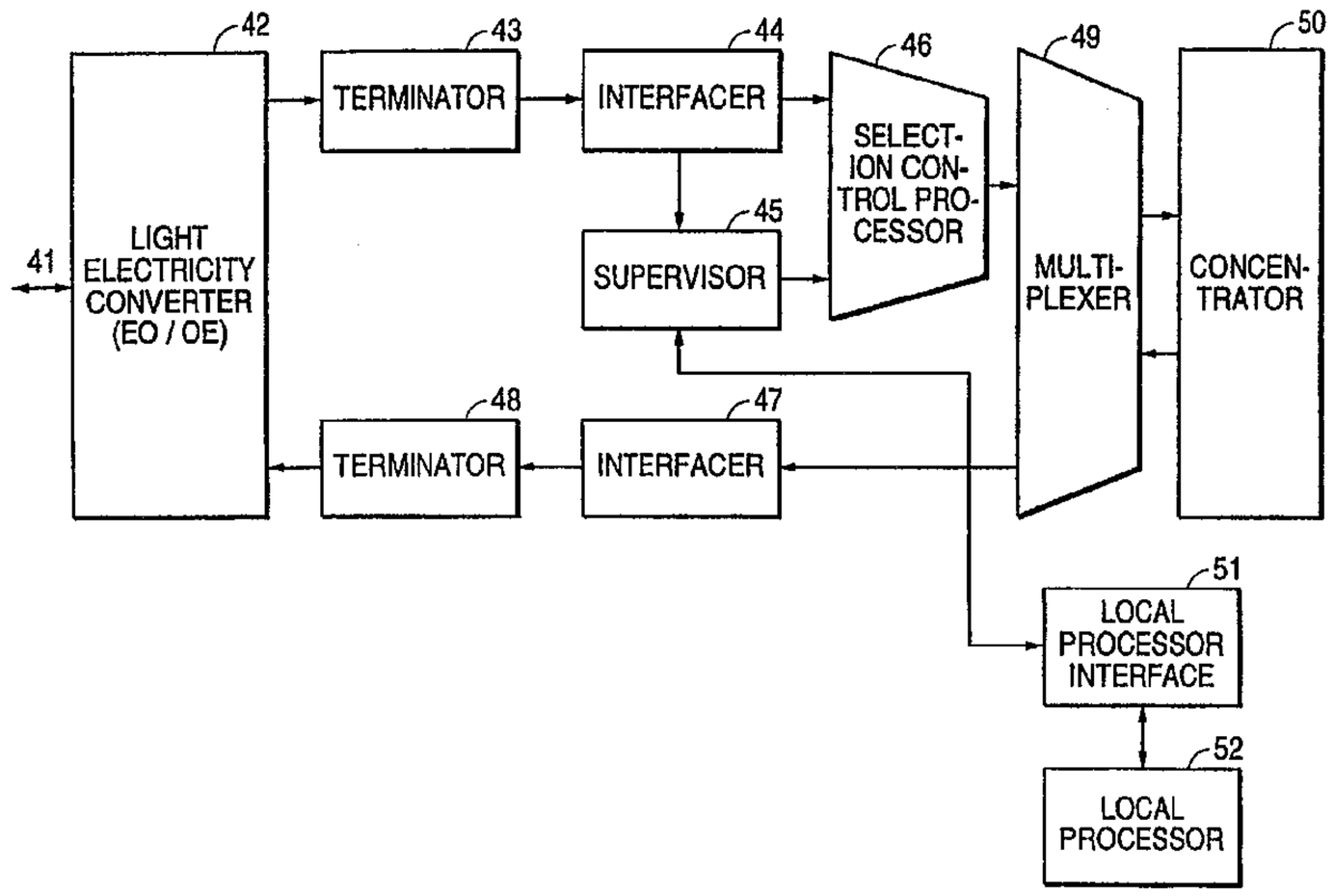

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FIG. 1

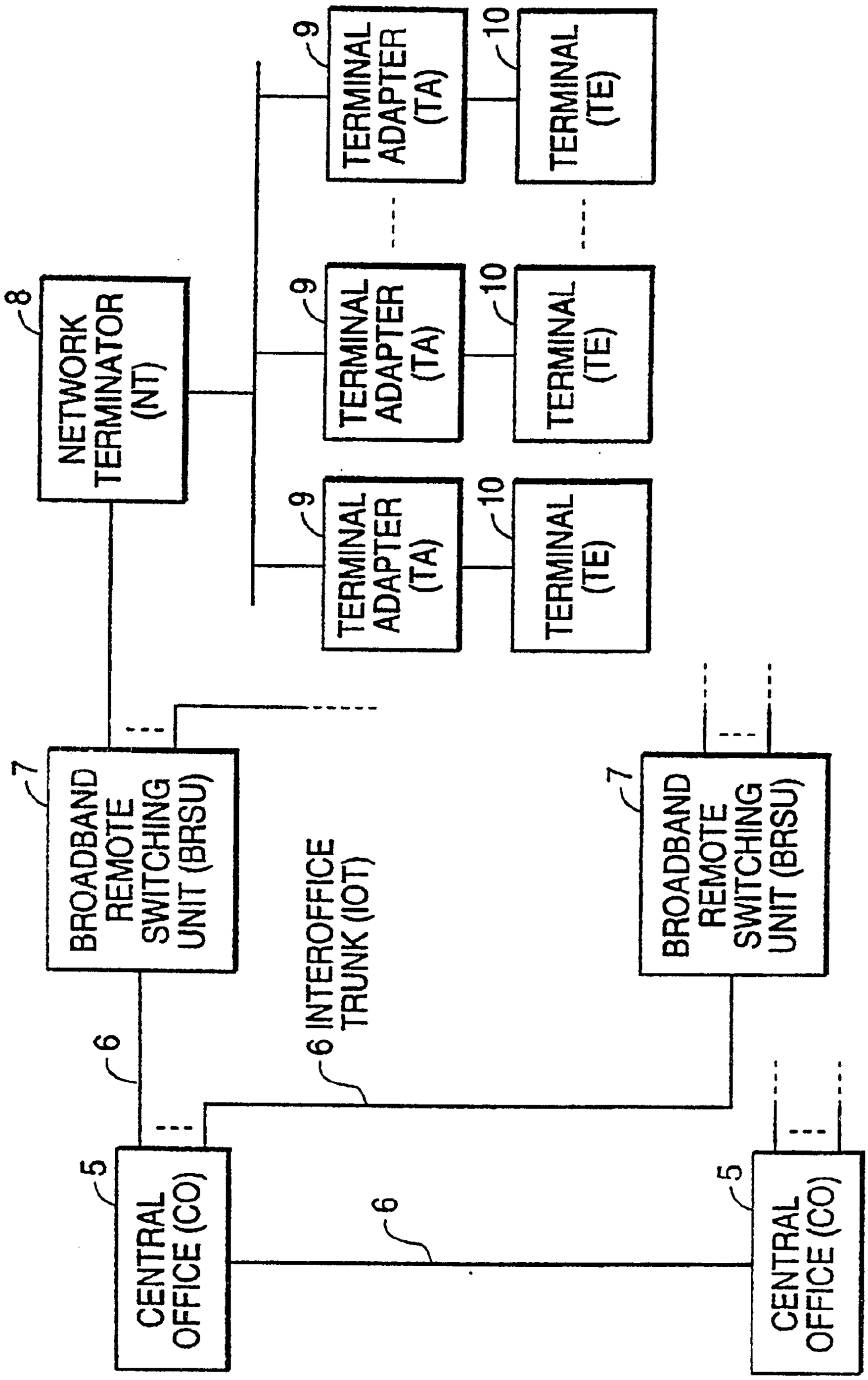

CENTRAL OFFICE (CO)
5
6
CENTRAL OFFICE (CO)
5
6 INTEROFFICE TRUNK (IOT)
BROADBAND REMOTE SWITCHING UNIT (BRSU)
7
BROADBAND REMOTE SWITCHING UNIT (BRSU)
7
NETWORK TERMINATOR (NT)
8
TERMINAL ADAPTER (TA)
9
TERMINAL (TE)
10
TERMINAL ADAPTER (TA)
9
TERMINAL (TE)
10
TERMINAL ADAPTER (TA)
9
TERMINAL (TE)
10
TERMINAL ADAPTER (TA)
9
TERMINAL (TE)
10

FIG. 2

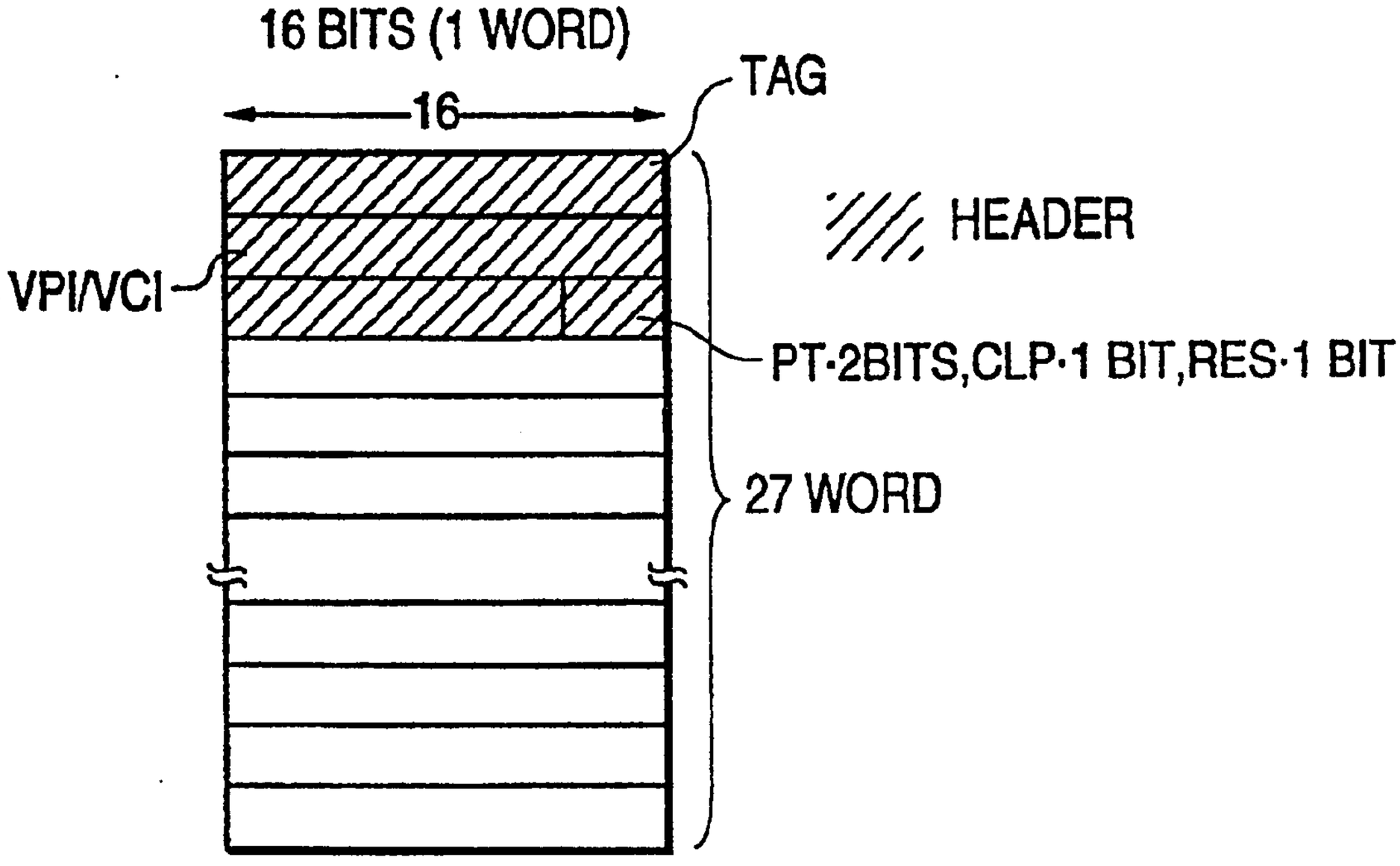

16 BITS (1 WORD)
16
TAG
HEADER
VPI/VCI
PT·2BITS,CLP·1 BIT,RES·1 BIT
27 WORD

FIG. 5(B)

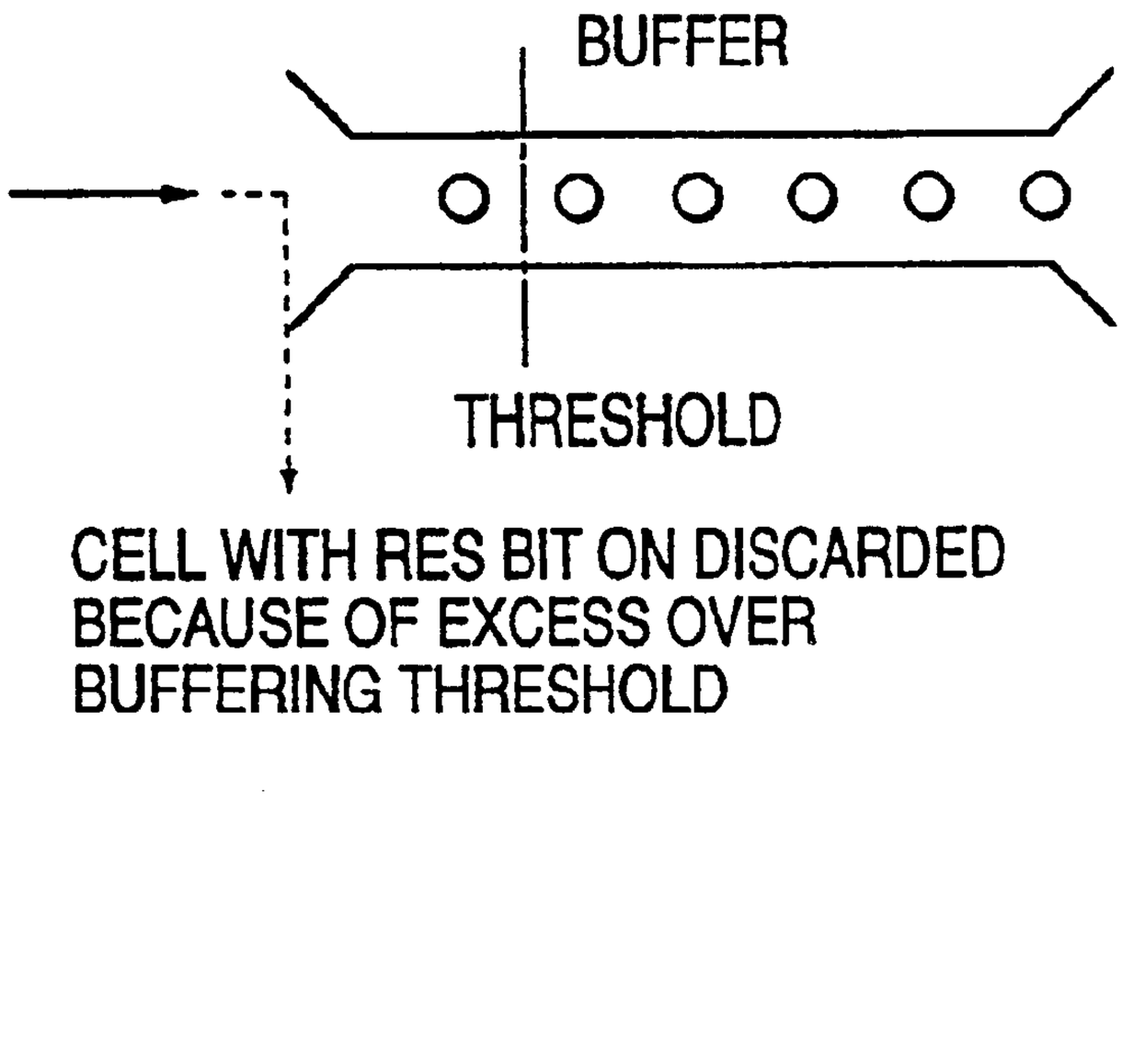

BUFFER
THRESHOLD
CELL WITH RES BIT ON DISCARDED
BECAUSE OF EXCESS OVER
BUFFERING THRESHOLD

FIG. 3

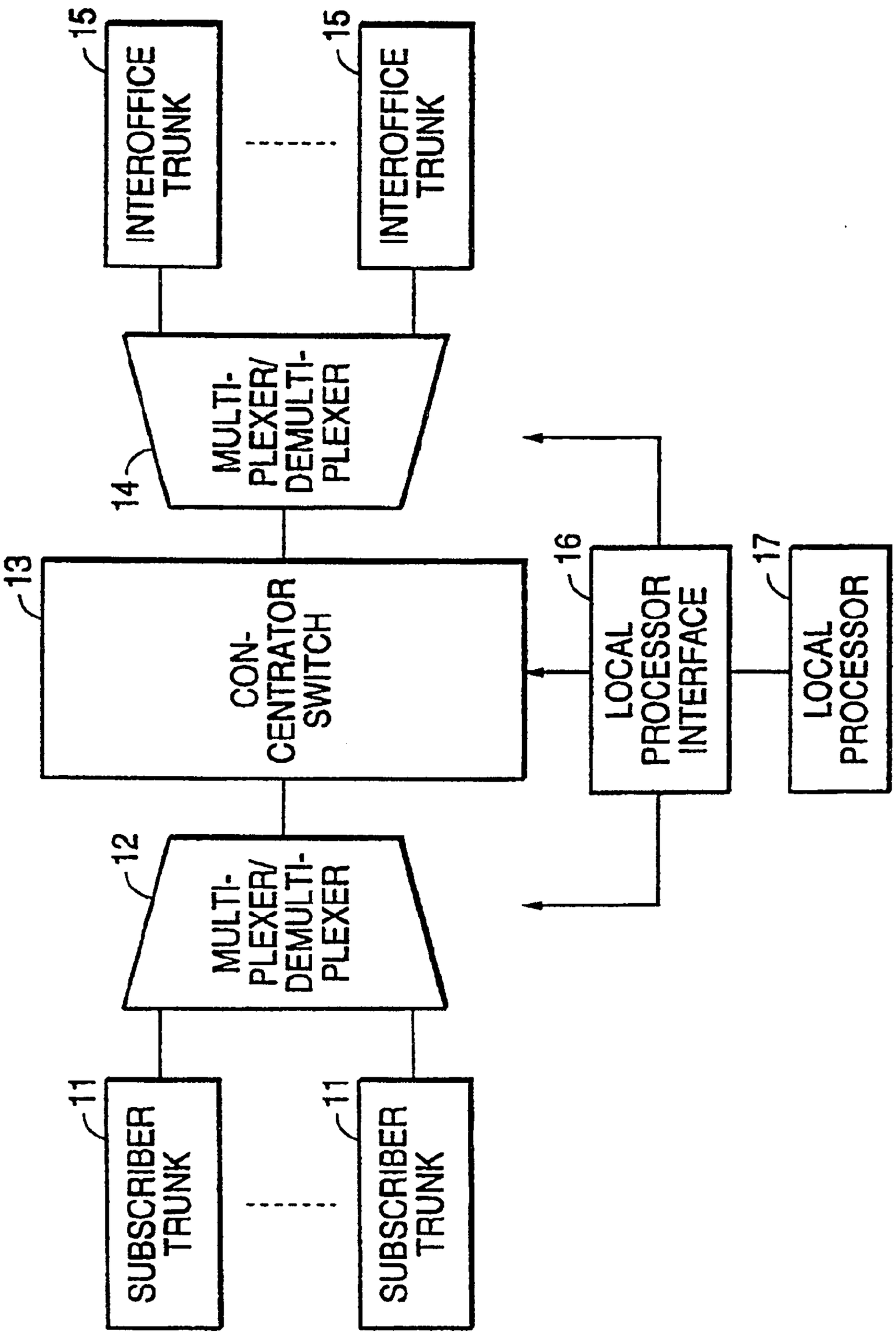

15
INTEROFFICE TRUNK
15
INTEROFFICE TRUNK
14
MULTI-PLEXER/ DEMULTI-PLEXER
13
CON-CENTRATOR SWITCH
16
LOCAL PROCESSOR INTERFACE
17
LOCAL PROCESSOR
12
MULTI-PLEXER/ DEMULTI-PLEXER
11
SUBSCRIBER TRUNK
11
SUBSCRIBER TRUNK

FIG. 4

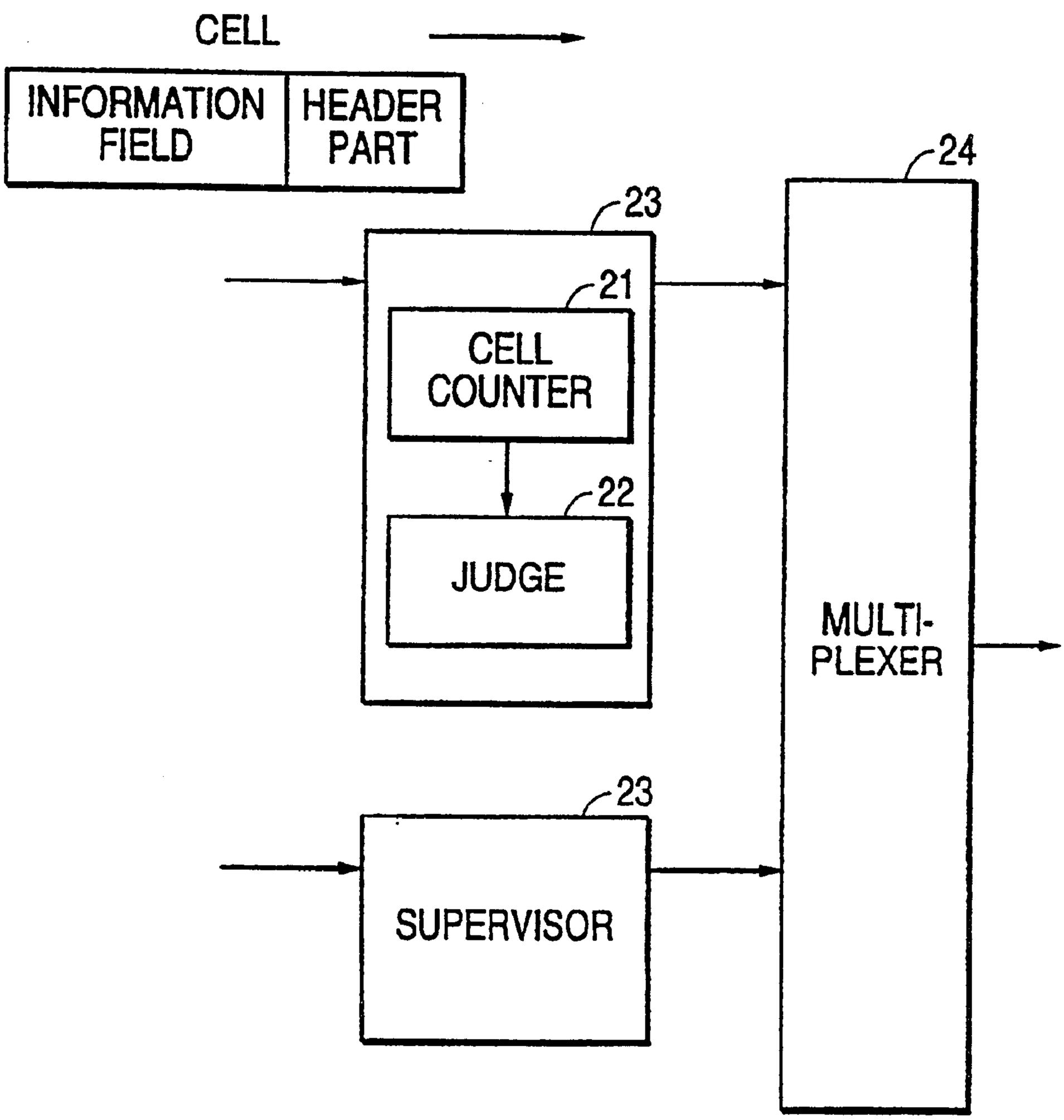
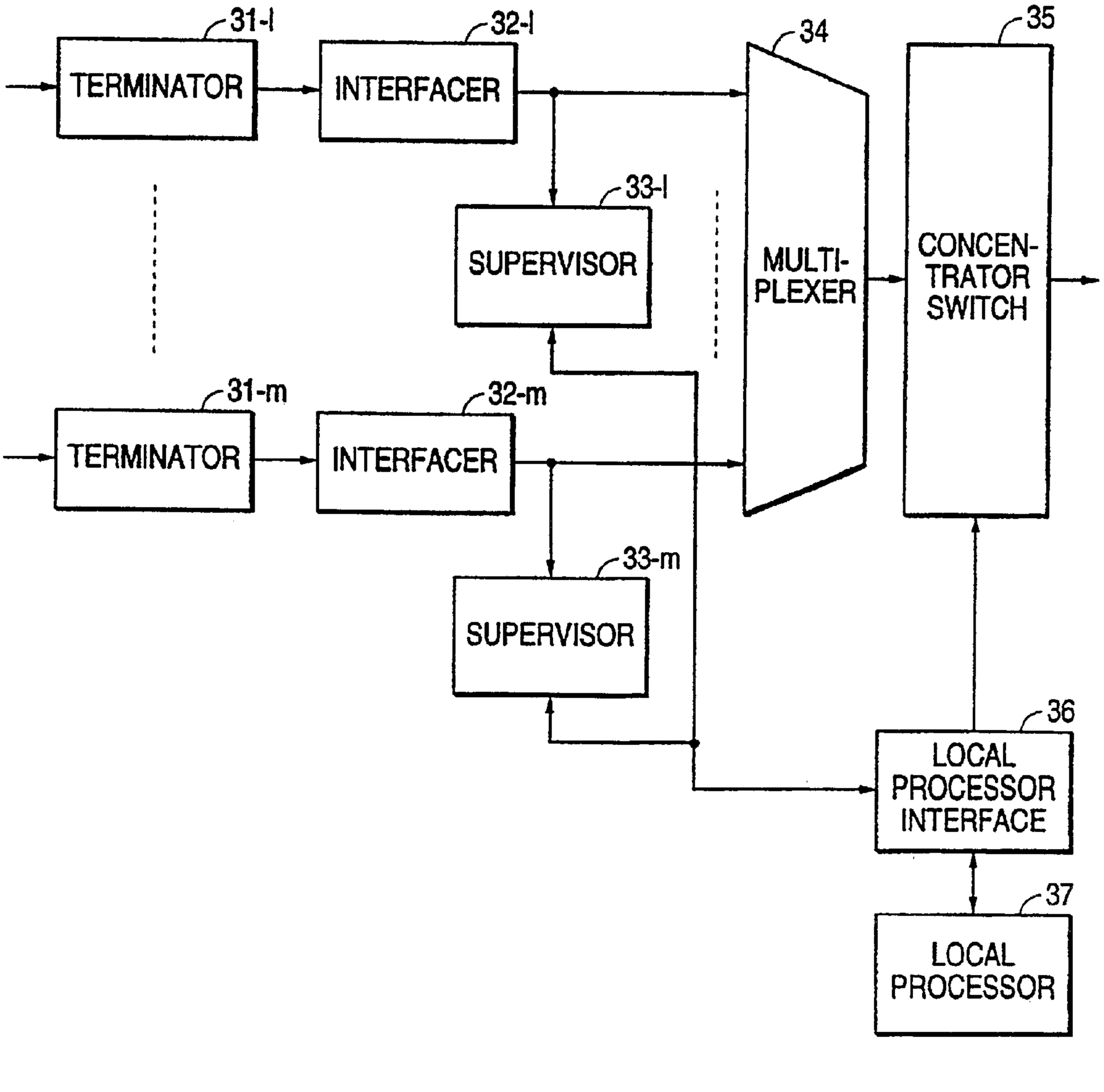

CELL
INFORMATION FIELD
HEADER PART
23
21
CELL COUNTER
22
JUDGE
24
MULTI-PLEXER
23
SUPERVISOR

FIG. 5(A)


31-l
TERMINATOR
32-l
INTERFACER
34
35
33-l
SUPERVISOR
MULTI-
PLEXER
CONCEN-
TRATOR
SWITCH
31-m
TERMINATOR
32-m
INTERFACER
33-m
SUPERVISOR
36
LOCAL
PROCESSOR
INTERFACE
37
LOCAL
PROCESSOR

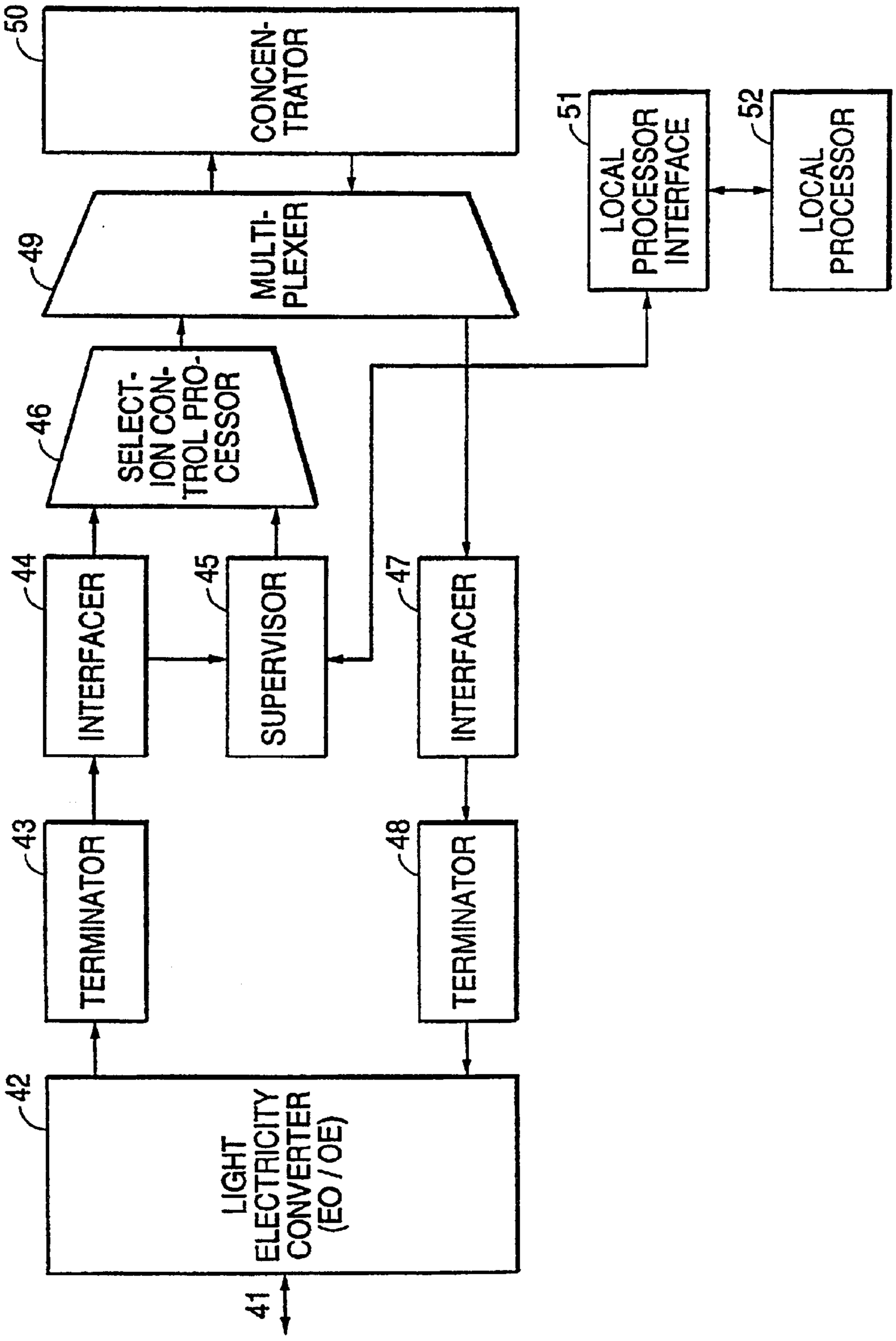

50
CONCEN-
TRATOR
51
LOCAL
PROCESSOR
INTERFACE
52
LOCAL
PROCESSOR
49
MULTI-
PLEXER
46
SELECT-
ION CON-
TROL PRO-
CESSOR
44
INTERFACER
45
SUPERVISOR
47
INTERFACER
43
TERMINATOR
48
TERMINATOR
42
LIGHT
ELECTRICITY
CONVERTER
(EO / OE)
41

FIG. 6

FIG. 7

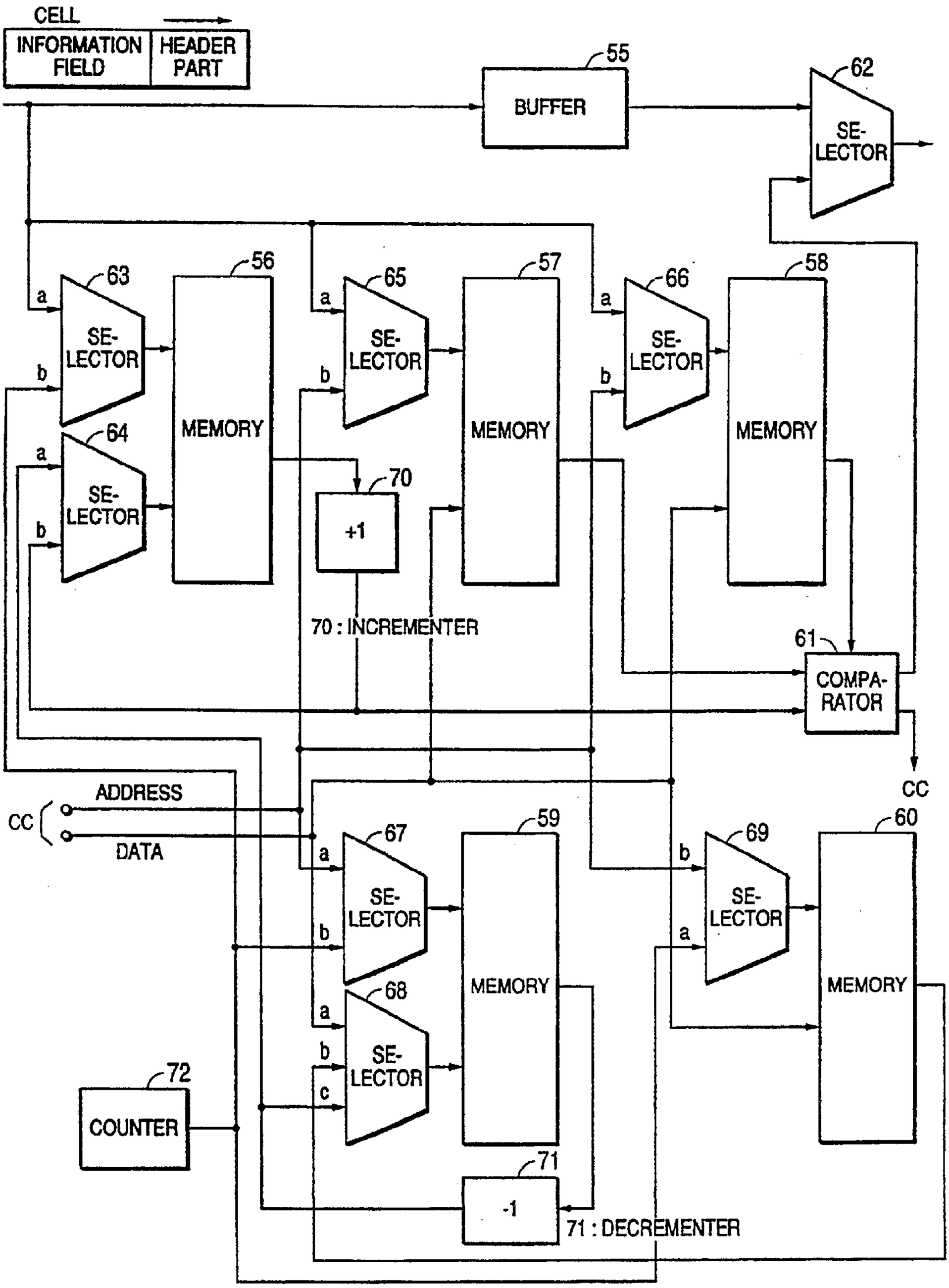
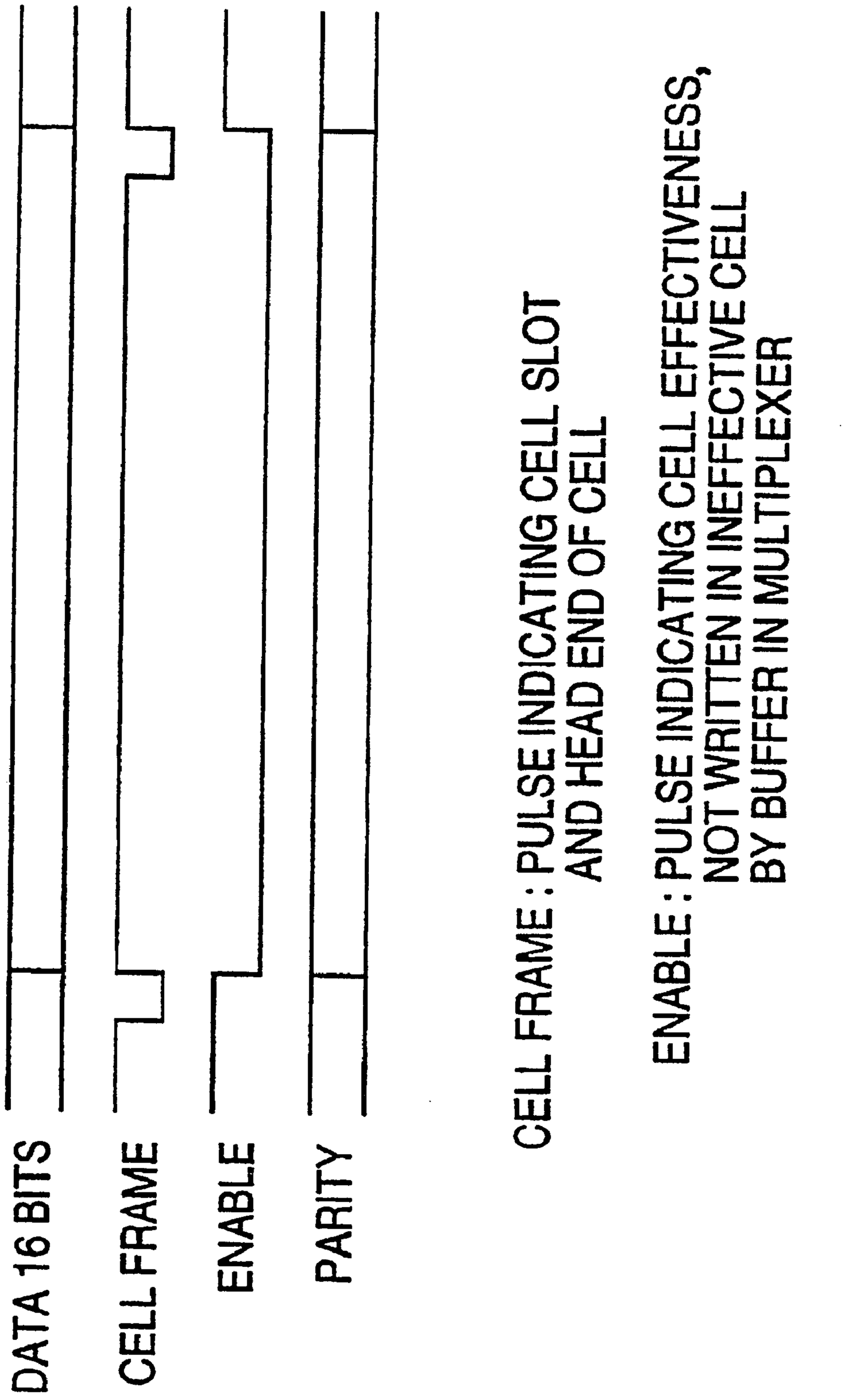

CELL
INFORMATION FIELD
HEADER PART
55
BUFFER
62
SE-LECTOR
63
64
65
66
56
57
58
MEMORY
a
b
70
+1
70 : INCREMENTER
61
COMPA-RATOR
CC
ADDRESS
DATA
67
68
69
59
60
71
-1
71 : DECREMENTER
72
COUNTER
c

FIG. 8


DATA 16 BITS
CELL FRAME
ENABLE
PARITY
CELL FRAME : PULSE INDICATING CELL SLOT AND HEAD END OF CELL
ENABLE : PULSE INDICATING CELL EFFECTIVENESS, NOT WRITTEN IN INEFFECTIVE CELL BY BUFFER IN MULTIPLEXER

SUPERVISION CONTROL SYSTEM

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

This application is a continuation of application Ser. No. 07/780,121, filed Oct. 19, 1991, now abandoned.

BACKGROUND OF THE INVENTION

This invention pertains to a supervision control system for supervising the inflow of cells to an ATM switching system.

The ATM switching system switches cells having fifty-four (54) bytes split from various data, such as voice data, image data and other numerical data, and transmits in a multiplexed form the various data at different transmission speed. Of the fifty-four (54) bytes in a cell, forty-eight (48) bytes form an information field and six (6) bytes form a header part. Of the four (4) bytes, i.e. thirty-two (32) bits, in the header part excluding two (2) bytes forming a tag, twenty-eight (28) bits indicate a VPI/VCI (virtual path identifier/virtual channel identifier), two (2) bits indicate a PT (payload type), one (1) indicates a CLP (cell loss priority) and one (1) bit is for a RES (reserve).

A buffer in a multiplexer for these cells can experience an overflow when an unexpected number of cells flow in. Since overflowing cells are discarded, the communications quality is deteriorated. Although such a problem can be avoided by using a buffer having a larger capacity, a larger delay results, which is critical in transmitting voice data, image data, and so forth.

Therefore, a buffer is required in which the occurrence of an overflow and its effect are minimized.

DESCRIPTION OF THE RELATED ART

FIG. **1** is a block diagram of an ATM switching system.

As shown in FIG. **1**, a plurality of terminals (TE) **10** are connected through respective terminal adapters (TA) **9** to one of plural network terminators (NT) **8** in an ATM switching system.

The network terminators (NT) **8** are connected through respective interoffice trunks **6** to one (1) of plural broadband remote switching units (BRSU) **7**.

The broadband remote switching units (BRSU) **7** are connected to one (1) of a plurality of central offices (CO) **5**.

The interoffice trunks **6** interconnect the central offices (CO) **5**. The interoffice trunks **6** and subscriber lines are high speed transmission paths, such as an optical transmission path e.g. comprising a SONET (Synchronous Optical Network), having bands of one hundred fifty-five mega-herts (155 MHz), six hundred twenty-two mega-herts (622 MHz) or higher.

FIG. **2** shows a cell configuration.

As described earlier, voice data, image data, numerical data, etc. from the terminals (TE) **10** are split into cells having fifty-four (54) bytes. Because one (1) word is defined to comprise two (2) bytes, a cell has twenty-seven (27) words. As shown in FIG. **2**, of the fifty-four (54) bytes in a cell, forty-eight (48) bytes form an information field and six (6) bytes form a header part. Of the six (6) bytes, i.e. forty-eight (48) bits, in the header part, two (2) bytes, i.e. sixteen (16) bits, form a tag, twenty-eight (28) bits indicate a VPI/VCI (virtual path identifier/virtual channel identifier), two (2) bits indicate a PT (payload type), one (1) bit indicates a CLP (cell loss priority) and one (1) bit is for a RES (reserve).

The network terminators (NT) **8** send the cells to the broadband remote switching unit (BRSU) **7**.

The terminal adapters (TA) **9** receive cells from corresponding terminals (TE) **10** through the network terminators (NT) **8** and send the decelled voice data, image data, numerical data, etc. to the terminals (TE) **10**.

FIG. **3** is a block diagram of one (1) of the broadband remote switching units (BRSU) **7**.

A multiplexer/demultiplexer (MDX) **12** multiplexes cells asynchronously inputted from subscribers through a buffer and transmitted over a plurality of subscriber line trunks **11**, which are connected to respective subscriber lines. A concentrator switch (CSW) **13** switches the multiplexed cells. A multiplexer/demultiplexer (MDX) **14** demultiplexes the switched cells over to an appropriate one (for the predetermined central office) of a plurality of interoffice trunks **15**, which form interoffice cell transmission paths.

The multiplexer/demultiplexer (MDX) **14** multiplexes cells asynchronously inputted from correspondent subscribers through a buffer and transmitted over the interoffice trunks **15**. The concentrator switch (CSW) **13** switches the multiplexed cells. The multiplexer/demultiplexer (MDX) **12** demultiplexes the switched cells over to an appropriate one (for the predetermined subscriber) of a plurality of subscriber line trunks **11**.

A local processor interface (LPIF) **16** connects a local processor (LPR) **17** with the concentrator switch (CSW) **13** and multiplexers/demultiplexers (MDXs) **12** and **14**.

When a larger number of cells flow into the multiplexer/demultiplexer (MDX) **12**, its buffer causes some cells to overflow. Therefore, a virtual path is set at a call-up by having a subscriber declare his cell transmission band and by judging whether or not the cells can be multiplexed in the declared band.

In this case, if this subscriber sends cells over the declared band, cells from other subscribers who share the same buffer with this subscriber are also discarded.

That is, if any subscriber sends cells over the declared band, a large ill-effect occurs such that cells from other subscribers are also discarded.

SUMMARY OF THE INVENTION

This invention pertains to a supervision control system for supervising the inflow of cells to an ATM switching system.

It aims at avoiding a congestion state caused by a cell inflow over a band declared by a subscriber.

It configures a supervision control apparatus for an ATM (Asynchronous Transmission Mode) cell switching system comprising a supervisor and a multiplexer. The supervisor further comprises a cell counter and a judge. The cell counter counts cells transmitted from a subscriber in a predetermined duration unit. The judge attaches a sign to the cells when the value counted by the cell counter exceeds a predetermined value. The multiplexer discards the cells to which the sign is attached when a buffer does not have enough capacity during a cell multiplexation.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram of an ATM switching system;

FIG. **2** shows a cell configuration;

FIG. **3** is a block diagram of one (1) of the broadband remote switching units (BRSU) **7**;

FIG. **4** is a block diagram of this invention;

FIG. **5**A is a block diagram of parts pertinent to a first embodiment of this invention;

FIG. **5**B illustrates an example of cell discarding;

FIG. **6** is a block diagram of a subscriber line trunk pertinent to a second embodiment of this invention;

FIG. **7** is a block diagram of the supervisor and the selection control processor pertinent to the second embodiment of this invention; and

FIG. **8** illustrates the input interface of a multiplexer.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

A supervision control system of this invention prioritizes discarding of cells overflowing from a buffer by attaching a high cell-loss-priority sign to cells flowing in over a band declared by a subscriber, thereby minimizing ill-effects to other subscribers.

FIG. **4** is a block diagram of this invention.

The supervision control apparatus for an ATM (Asynchronous Transmission Mode) cell switching system comprises a supervisor **23** and a multiplexer **24**. A supervisor **23** further comprises a cell counter **21** and a judge **22**. The cell counter **21** counts cells transmitted from a subscriber in a predetermined duration unit. The judge **22** attaches a sign to the cells when the value counted by the cell counter **21** exceeds a predetermined value. The multiplexer **24** discards the cells to which the sign is attached when a buffer does not have enough capacity during a cell multiplexation.

That is, the cell counter **21** in the supervisor **23** counts cells flowing in from a subscriber in a predetermined duration unit. The judge **22** in the supervisor **23** judges whether or not the cells are flowing in over the band declared by the subscriber and attaches a sign to a predetermined bit in the excess cells flowing in over the declared band. The multiplexer **24** multiplexes the cells having the sign for their transmission when its buffer has the capacity to handle them. However, the multiplexer **24** discards them with high priority, when neither the buffer in the multiplexer **24** itself nor the buffer in a concentrator switch, or in a demultiplexer, connected to the multiplexer **24** has a capacity to handle the cells, thereby ensuring the multiplexation and transmission of cells having no such sign inputted from other subscribers.

Alternatively, the judge **22** in the supervisor **23** can set a first judging threshold and a second judging threshold. The first judging threshold corresponds to a band declared by a subscriber. The second judging threshold is set higher than the first judging threshold. The judge **22** attaches a sign to the inflowing cells from a subscriber in excess of the first judging threshold, and discards the inflowing cells from the subscriber in excess of the second judging threshold.

That is, the judge **22** sets the first and second judging thresholds in correspondence with a band declared by a subscriber. The judge **22** attaches a sign to the excess inflowing cells over the first judging threshold by appropriately marking the CLP (cell loss priority) bit or the RES (reserve) bit of the cell, thereby prioritizing the discarding of such cells, when neither the buffer in the multiplexer **24** itself nor the buffer in a concentrator switch, or in a demultiplexer, connected to the multiplexer **24** has a capacity to handle the cells. The judge **22** always discards the inflowing cells in excess of the second judging threshold, because they are likely to cause an overflow in the buffer.

Embodiments of this invention are explained in further detail by referring to some of the attached drawings.

First Embodiment

FIG. **5**A is a block diagram of parts pertinent to a first embodiment of this invention.

Subscriber line terminators **31-1** through **31**-m each paired with the corresponding one of interfacers **32-1** through **32**-m are equivalent to subscriber line trunks connecting subscribers to the ATM cell switching system. A multiplexer **34** receives cells from subscribers by way of the subscriber line terminators **31-1** through **31**-m and the interfacers **32-1** through **32**-m. Supervisors **33-1** through **33**-m respectively supervise cell inflows to the multiplexer **34** via the subscriber line terminators **31-1** through **31**-m and the interfacers **32-1** through **32**-m.

When a subscriber calls up, he declares the band to be occupied. A processor **37** reads from a cell its VCI (virtual channel identifier) for specifying the switchers and the subscriber and its VPI (virtual path identifier) for specifying the paths among the switchers, and notifies the supervisors **33-1** through **33**-m of the VCI/VPI and the maximum number of cells, set in correspondence with the subscriber declared band, passing through in a predetermined duration unit.

The supervisors **31-1** through **33**-m count the number of cells having particular VCIs/VPIs in the predetermined duration units, and attach a sign to the cells in excess of the maximum number of cells, set in correspondence with the subscriber declared band, passing through in a predetermined duration unit, for example, by marking the CLP (cell loss priority) bit in those cells.

FIG. **5**B illustrates an example of cell discarding.

Alternatively, the supervisors **33-1** through **33**-m can attach a sign to the cells in excess of the maximum number of cells, set in correspondence with the subscriber declared band, passing through in a predetermined duration unit, by marking the RES (reserve) bit in those cells, as shown in FIG. **5**B.

The multiplexer **34** has a buffer. It multiplexes cells from subscribers and supplies the multiplexed cells to a concentrator switch **35**. However, it multiplexes cells having the sign marked in their CLP bit or in their RES bit only when the buffer has enough capacity, and discards them with high priority when the buffer does not have enough capacity. This ensures the multiplexation of cells from subscribers transmitted within the declared bands.

Also, even when the buffer in the multiplexer **34** has enough capacity to handle the cells, the buffer at an input terminal or at an output terminal of a device connected in a later stage, such as the concentrator switch **35** and a demultiplexer on the receiving side, discards the cells, if it does not have enough capacity.

Also, the supervisors **33-1** through **33**-m can attach a sign to the cells in excess of a first judging threshold equivalent to the maximum number of cells, set in correspondence with the subscriber declared band, passing through in a predetermined duration unit, by marking either the CLP bit or the RES bit in those cells. The multiplexer **34** prioritizes the discarding of those cells having the sign, when its buffer lacks enough capacity. Other devices connected in later stages discard cells similarly, when their respective buffers lack enough capacity. When the number of cells passing through in a predetermined duration unit further increases and reaches a second judging threshold, the multiplexer **34** can be made to perform a control such that the excess cells over the second judging threshold are discarded regardless of the available capacity of the buffer in the multiplexer **34**. The local processor interface **36** notifies the local processor **37** of the results of processing by the supervisors **33-1** through **33**-m.

Second Embodiment

FIG. **6** is a block diagram of a subscriber line trunk pertinent to a second embodiment of this invention.

A subscriber line **41** such as a SONET based optical transmission path transmits cells in light signals. A light-electricity (electro-optic/optoelectric) converter (EO/OE) **42** converts the cells in light signals to cells in electric signals and supplies the converted cells through a terminator **43** and an interfacer **44** to a selection control processor **46**. A local processor **52** notifies a supervisor **45** through a local processor interface **51** of a VCI/VPI and first and second judging thresholds set correspondingly to a subscriber declared band. An alternative arrangement can be made such that the processor notifies the supervisor **45** of a subscriber declared band and the supervisor **45** sets first and second judging thresholds accordingly.

The supervisor **45** counts the number of cells having a particular VCI/VPI passing through the interfacer **44** in a predetermined duration unit for a comparison with the first and second judging thresholds. The supervisor **45** has the selection control processor **46** turn on e.g. the CLP bit in the header part of the cells exceeding the first judging threshold, so that discarding of those cells is prioritized when the buffer of a multiplexer **49**, or the buffer of a device connected in a later stage, lacks enough capacity. Also, the supervisor **45** has the selection control processor **46** turn on e.g. the RES bit in the header part of the cells exceeding the second judging threshold, so that those cells are supplied to the multiplexer **49** as empty cells, thereby causing those cells to be discarded anyway regardless of the available capacity in the buffer of the multiplexer **49**. This is because the multiplexer **49** does not send empty cells to a concentrator switch **50**.

FIG. **7** is a block diagram of the supervisor **45** and the selection, control processor **46** pertinent to the second embodiment of this invention.

A buffer **55** delays cells in correspondence with the delays caused by respective supervisions.

A memory **56** counts the number of cells passing through in a predetermined duration unit.

Memories **57** and **58** respectively store first and second judging thresholds.

A memory **59** measures an elapse of the predetermined duration unit.

A memory **60** stores duration unit data.

When the supervisor **45** commences its operations, a processor CC instructs selectors **65**, **66** and **69** to select their "b" side inputs and to output them to respective address terminals of memories **57**, **58** and **60**, which receive data from the processor CC as respective data inputs. The processor CC supplies to "b" side inputs of selectors **65**, **66** and **69** an address by which memories **57**, **58** and **60** are accessed. The processor CC accesses memories **57**, **58** and **60** to have them respectively store the first judging threshold, the second judging threshold and the duration unit data.

When the supervisor **45** commences its operations, the processor CC also instructs selectors **67** and **68** to select their "a" side inputs and to output, so that memory **59** receives an address and data from the processor CC. Memory **59** stores as its initial data duration unit data similar to those stored in memory **60**. The processor stores data to be stored in memories **57**, **58**, **59** and **60** at respective addresses corresponding to VPIs/VCIs.

When the supervisor **45** commences its operations, memory **60** is reset and its stored data are initialized to zero (0).

That is, the processor CC supplies the first and second judging thresholds set correspondingly to the subscriber

declared band, the duration unit data indicating the supervision cycle and the addresses corresponding to the subscriber assigned VPIs/VCIs. Memory **57** stores the first judging threshold. Memory **58** stores the second judging threshold. Memory **60** stores the duration unit data. Although all the duration unit data can be set the same, they can be set in correspondence with the subscriber characteristics. This is because pass-through cells sent from a subscriber in a burst need to be counted over a comparatively long period of time, whereas those sent from another in a more or less constant speed can be counted over a relatively short period of time.

Meanwhile, when the supervisor **45** commences its operation, selectors **63**, **65** and **66** select their "a" side inputs, so that the memories **56**, **57** and **58** are accessed by using the VPIs/VCIs in the header part of cells as addresses. Selector **64** has memory **56** count the number of cells passing through by having an incrementer **70** increment the value by one (1) in an address region of memory **56** corresponding to the VPIs/VCIs.

Selector **68** has memory **59** store duration unit data stored in memory **60**, each time the value stored in memory **59** becomes zero (0). A decrementer **71** decrements the value stored in memory **59** by one (1). When the value stored in memory **59** reaches zero (0), memory **56** clears its address regions corresponding to the VPIs/VCIs set in correspondence with the duration unit data. That is, memory **56** counts cells passing through in predetermined units in the address fields corresponding to their VPIs/VCIs. Then, memory **59** again stores duration unit data stored in memory **60**, again.

A counter **72** generates respective addresses for managing duration units e.g. up to the maximum value of the VPIs/VCIs. Although this is not shown in the drawings, the counter **72** receives a clock signal, accesses memory **59**, each time its own value is incremented by one (1), by using the incremented value as the address, and decrements the value stored in memory **59** by one (1). At this time, selector **67** selects its "b" side input and selector **68** selects its "c" side input.

A count cycle [from zero (0) to next zero (0)] in the counter **72** becomes the basis of the duration unit data stored in the memory **60**. The values obtained by multiplying the count cycle by the duration unit data become duration units corresponding to the VPIs/VCIs.

When the value stored in memory **59** accessed by value of the counter **72** becomes zero (0), selector **68** switches its selection from "c" side input to "b" side input, thereby loading the duration unit data in memory **60**, again.

The counting by the counter **72** enables the addresses corresponding to all the VPIs/VCIs to be specified, thereby realizing duration units to be managed.

Ordinarily, selectors **63**, **65**, and **66** select their "a" side inputs, access the corresponding address each time a cell passes through, and perform the following operations.

The count value of the cells passing through stored in memory **56** is supplied to the comparator **61** through the incrementer **70**. The comparator **61** receives the first judging threshold stored in memory **57** and the second judging threshold stored in memory **58**. When the number of cells passing through is less than the first and second thresholds, the comparator **61** does not control the selector **62** and cells passing through the buffer **55** also pass through selector **62** without any obstruction. Also, when the number of cells passing through is more than the first threshold but less than the second threshold, the excess cells over the first judging threshold are transmitted after selector **62** turns on the CLP

bit in the header part of those cells. Finally, when the number of cells passing through is more than the second judging threshold, selector **62** converts the excess cells over the second judging threshold to empty cells, where all the bits are zero (0). The comparator **61** notifies the processor CC of the result of respective processings.

Because selector **62** supplies cells to the multiplexer for cell multiplexation, cells with the CLP bit on are discarded when the buffer lacks the capacity. Since cells from other subscribers are within their declared bands, even if a subscriber sends cells in excess of his declared band, ill-effects on other subscribers are minimized. When the numbers of cells from other subscribers are small, i.e. when the buffer has enough capacity, the multiplexer multiplexes even the cells with their CLP bit on.

Cells far exceeding the declared band are discarded, e.g. through an empty cell conversion, to avoid discarding of cells from other subscribers within their declared bands.

In the first and second embodiments of this invention, the supervisors **23**, **33-1** through **33**-m, and **45** output cells in which all the bits are zero (0) to multiplexers **24**, **34** and **49**, where these cells are actually discarded. However, this invention is not limited to such a configuration.

FIG. **8** illustrates the input interface of a multiplexer.

As shown in FIG. **8**, the multiplexers **24**, **34** and **49** can use an input interface such that a "Data Line" comprises sixteen (16) bits, a "Cell Frame" comprises one (1) bit, an "Enable" comprises one (1) bit and a "Parity" comprises one (1) bit. The "Data Line" is a signal line for transmitting the cell width. "Cell Frame" is a signal line specifying the head end of each cell by a pulse indicating a "Cell Slot". "Enable" is a signal line specifying the cells' effectiveness. "Parity" is a data error scanning line.

When the numbers of cells are more than the second threshold, the supervisors **23**, **33-1** through **33**-m and **45** turn off "Enable" without performing any data control. The multiplexers **23**, **34** and **49** discard cells without multiplexing them when their "Enable" is off.

This invention is not limited to those embodiments, but instead can be applied in various derivative forms. For instance, it goes without saying that counting of the number of cells passing through by memory **56** can be substituted by counting by an ordinary counter.

Further, this invention can be applied also to any cell switching system, in addition to an ATM cell switching system.

As explained earlier, this invention causes an ATM switching system to have its cell counter **21** in its supervisor **23** to count the cells inputted from respective subscribers. When the judge **22** discovers that the number of cells inputted from a particular subscriber exceeds his declared band, the judge **22** attaches a sign to the excess cells to be sent to the multiplexer **24** e.g. by turning on their CLP bit. When its buffer has enough capacity, the multiplexer **24** ordinarily multiplexes the cells. However, when its buffer lacks it, the multiplexer **24** prioritizes the discarding of these cells. Thus, even if its buffer lacks enough capacity, the multiplexer **24** prioritizes the multiplexation of cells from other subscribers, as long as such cells are within their declared bands. Hence, this invention produces a distinct advantage of eliminating a possible ill-effect on others when a particular subscriber sends his cells beyond his declared band, while maintaining the best communication quality by avoiding unnecessary cell discarding.

Alternatively, this invention can be structured such that first and second judging thresholds are used for an even finer cell discarding control. That is, a sign is attached to excess cells over the first judging threshold e.g. by turning on the CLP bit, and excess cells over the second judging threshold are converted to empty cells and discarded. As a result, cells exceeding a declared band by a narrow margin can be multiplexed ordinarily depending on the availability of buffering capacity, while cells exceeding a declared band by a wide band are discarded to minimize the ill-effect on other subscribers.

Thus, this invention is effective in reduction of discarding cells within declared bands and in preventing a deterioration in communications quality by supervising cells flowing in an ATM cell switching system.

What is claimed is:

1. A supervision control method for an asynchronous transmission mode cell switching system comprising the steps of:

(*a*) *storing a plurality of bandwidth data which are pre-assigned to a plurality of sources of cells, and are stored in memory regions at memory addresses, each of the memory addresses being operatively accessed based on one of a plurality of identified virtual connections;*

(**[**a**]***b*) counting cells having *one of the plurality of identified virtual connections formed by* a particular virtual channel identifier and a particular virtual path identifier transmitted from a subscriber in a predetermined duration unit, by incrementing a count value stored in **[**a**]** *one of the* memory **[**region**]** *regions* having an address uniquely accessed with said particular virtual channel identifier and said particular virtual path identifier;

(**[**b**]***c*) attaching a sign to the cells when the count value incremented in said step (**[**a**]***b*) exceeds a predetermined value; and

(**[**c**]***d*) discarding the cells to which said sign is attached when a buffer does not have enough capacity to multiplex the cells.

2. A supervision control method for an asynchronous transmission mode cell switching system comprising the steps of:

(a) counting cells having a particular virtual channel identifier and a particular virtual path identifier received from a subscriber in a predetermined unit by incrementing a count value stored in a memory region having an address uniquely accessed with said particular virtual channel identifier and said particular virtual path identifier;

(b) attaching a sign to the cells when the count value incremented in said step (a) exceeds a first predetermined value;

(c) discarding the excess cells over a second predetermined value when the count value incremented in said step (a) exceeds the second predetermined value; and

(d) discarding the excess cells over the first predetermined value, to which the sign is attached in said step (b), when a buffer does not have enough capacity to multiplex the cells.

3. The supervision control method according to claim **2**, wherein said step (b) attaches based on the first predetermined value as a number of peak cells in the predetermined duration unit; and

wherein said step (a) comprises the substep of designating the first and second predetermined values based on a designation received from the subscriber.

4. A supervision control apparatus for an asynchronous transmission mode cell switching system comprising:

a memory to store a plurality of bandwidth data which are pre-assigned to sources of cells, the bandwidth data being stored at addresses thereof, each address being operatively accessed based on one of a plurality of identified virtual connections;

a cell counter including a memory to store a count value at an address uniquely accessed with *one of the plurality of identified virtual connections formed by* a particular virtual channel identifier and a particular virtual path identifier, for counting cells having said particular virtual channel identifier and said particular virtual path identifier transmitted from a subscriber in a predetermined duration unit by incrementing the count value;

a judge circuit for attaching a sign to the cells when the count value incremented by said cell counter exceeds a predetermined value; and

a multiplexer for discarding the cells to which the sign is attached when a buffer does not have enough capacity to multiplex the cells.

5. The supervision control apparatus according to claim **4**, wherein said judge circuit comprises a selector to switch when said sign is attached to a cell.

6. A supervision control apparatus for a cell switching system comprising:

a cell counter including a memory to store a count value at an address uniquely accessed with a particular virtual channel identifier and a particular virtual path identifier, for counting cells having said particular virtual channel identifier and said particular virtual path identifier transmitted from a subscriber in a predetermined duration unit;

a judge circuit for attaching a sign to the cells when the count value incremented by said cell counter exceeds a first predetermined value;

a selector for discarding the excess cells over a second predetermined value when the count value incremented by said cell counter exceeds the second predetermined value; and

a multiplexer for discarding the excess cells over the first predetermined value, to which said sign is attached by said judge circuit, when a buffer does not have enough capacity to multiplex the cells.

7. The supervision control apparatus according to claim **6**, wherein said first predetermined value is a number of average cells in said predetermined duration unit and said second predetermined value is a number of peak cells in said predetermined duration unit; and

wherein said system further comprises a receiver for receiving a designation from the subscriber to designate the first and second predetermined values.

8. The supervision control apparatus for an asynchronous transmission mode cell switching system according to claim **6**, wherein said selector outputs "0" upon discarding the cells.

9. A supervision control method in which cells, each including a header field with an identified virtual connection, are received from a plurality of sources, comprising:

storing a plurality of bandwidth data which are pre-assigned to the sources of the cells and are stored at memory addresses, each of the memory addresses being operatively accessed based on one of a plurality of identified virtual connections;

monitoring a transmission rate on the identified virtual connection of a received cell;

comparing the transmission rate with the bandwidth data stored at a memory address corresponding to the identified virtual connection of the received cell; and

marking the received cell to indicate a higher cell loss priority when the monitored transmission rate of the received cell exceeds a rate corresponding to the bandwidth data.

10. A supervision control method according to claim 9, wherein said monitoring comprises counting a number of the received cells having the same identified virtual connection in a predetermined duration unit.

11. A supervision control method, according to claim 9, further comprising discarding the received cell which has been marked to indicate a higher cell loss priority when a buffer has less capacity than an operative capacity for buffering the received cell.

12. A supervision control apparatus in which cells, each including a header field with an identified virtual connection, are received from a plurality of sources, comprising:

a memory to store a plurality of bandwidth data which are pre-assigned to the sources of the cells, and are stored at addresses thereof, each of the addresses being operatively accessed based on one of a plurality of identified virtual connections;

a cell counter to monitor a transmission rate on the identified virtual connection of a received cell;

a comparator to compare the monitored transmission rate of said cell counter with the bandwidth data stored at an address of said memory corresponding to the identified virtual connection of the received cell; and

a judge circuit to mark the received cell to indicate a higher cell loss priority when the monitored transmission rate exceeds a rate corresponding to the bandwidth data.

13. A supervision control apparatus according to claim 12, wherein said cell counter counts a number of the received cells having the same identified virtual connection in a predetermined duration unit.

14. A supervision control apparatus according to claim 12, further comprising a discard circuit to discard the received cell which has been marked to indicate a higher cell loss priority when a buffer has less capacity than an operative capacity to store the received cell.

15. A supervision control apparatus in which cells, each including a header field with an identified virtual connection, are received from a plurality of sources, comprising:

memory means for storing a plurality of bandwidth data which are pre-assigned to the sources of the cells, and are stored at addresses thereof, each of the addresses being operatively accessed based on one of a plurality of identified virtual connections;

monitor means for monitoring a transmission rate on the identified virtual connection of a received cell;

comparing means for comparing the monitored transmission rate of said monitor means with the bandwidth data stored at an address of said memory means corresponding to the identified virtual connection of the received cell; and

mark means for marking the received cell to indicate a higher cell loss priority when the monitored transmission rate exceeds a rate corresponding to the bandwidth data.

16. A supervision control apparatus according to claim 15, wherein said monitor means counts a number of the

received cells having the same identified virtual connection in a predetermined duration unit.

17. A supervision control apparatus according to claim 15, further comprising discard means for discarding the received cell which has been marked to indicate a higher cell loss priority when a buffer has less capacity than an operative capacity for buffering the received cell.

18. A supervision control apparatus, comprising:

a buffer memory to receive and store a cell including a header field with an identified virtual connection;

a memory to store a plurality of bandwidth data which are pre-assigned to sources of cells, and are stored at addresses thereof, each of the addresses being operatively accessed based on one of a plurality of identified virtual connections;

a cell counter to monitor a transmission rate on the identified virtual connection of a received cell;

a comparator to compare the monitored transmission rate of said cell counter with the bandwidth data stored at an address of said memory corresponding to the identified virtual connection of the received cell; and

a judge circuit to mark the received cell to indicate a higher cell loss priority when the monitored transmission rate exceeds a rate corresponding to the bandwidth data.

19. A supervision control apparatus according to claim 18, wherein said cell counter counts a number of the received cells having the same identified virtual connection in a predetermined duration unit.

20. A supervision control apparatus according to claim 18, further comprising a discard circuit to discard the received cell which has been marked to indicate a higher cell loss priority when said buffer memory has less capacity than an operative capacity to store the received cell.

21. A supervision control apparatus, comprising:

a receiver to receive a cell including a header field with an identified virtual connection;

a memory to store a plurality of bandwidth data which are pre-assigned to sources of cells, and are stored at addresses thereof, each of the addresses being operatively accessed based on one of a plurality of identified virtual connections;

a cell counter to monitor a transmission rate on the identified virtual connection of a received cell;

a comparator to compare the monitored transmission rate of said cell counter with the bandwidth data stored at an address of said memory corresponding to the identified virtual connection of the received cell; and

a judge circuit to mark the received cell to indicate a higher cell loss priority when the monitored transmission rate exceeds a rate corresponding to the bandwidth data.

22. A supervision control apparatus according to claim 21, wherein said cell counter counts a number of the received cells having the same identified virtual connection in a predetermined duration unit.

23. A supervision control apparatus according to claim 21, further comprising a discard circuit to discard the received cell which has been marked to indicate a higher cell loss priority when a buffer has less capacity than an operative capacity to store the received cell.

24. A supervision control apparatus, comprising:

a receiver to receive a cell including a header field with an identified virtual connection and a cell loss priority bit indicating a cell loss priority;

a memory to store a plurality of bandwidth data which are pre-assigned to sources of cells, and are stored at addresses thereof, each of the addresses being operatively accessed based on one of a plurality of identified virtual connections;

a cell counter to monitor a transmission rate on the identified virtual connection of a received cell;

a comparator to compare the monitored transmission rate of said cell counter with the bandwidth data stored at an address of said memory corresponding to the identified virtual connection of the received cell; and

a judge circuit to mark the cell loss priority bit to indicate a higher cell loss priority when the monitored transmission rate exceeds a rate corresponding to the bandwidth data.

25. A supervision control apparatus according to claim 24, wherein said cell counter counts a number of the received cells having the same identified virtual connection in a predetermined duration unit.

26. A supervision control apparatus according to claim 24, further comprising a discard circuit to discard the received cell which has been marked to indicate a higher cell loss priority when a buffer has less capacity than an operative capacity to store the received cell.

27. A supervision control apparatus in which a cell including a header field with an identified virtual connection and a cell loss priority bit indicating a cell loss priority, is received from a source, comprising:

a memory to store a plurality of bandwidth data which are pre-assigned to sources of cells, and are stored at addresses thereof, each of the addresses being operatively accessed based on one of a plurality of identified virtual connections;

a cell counter to monitor a transmission rate on the identified virtual connection of the received cell;

a comparator to compare the monitored transmission rate of said cell counter with the bandwidth data stored at an address of said memory corresponding to the identified virtual connection of the received cell; and

a judge circuit to mark the cell loss priority bit to indicate a higher cell loss priority when the monitored transmission rate exceeds a rate corresponding to the bandwidth data.

28. A supervision control apparatus according to claim 27, wherein said cell counter counts a number of the received cells having the same identified virtual connection in a predetermined duration unit.

29. A supervision control apparatus according to claim 27, further comprising a discard circuit to discard the received cell which has been marked to indicate a higher cell loss priority when a buffer has less capacity than an operative capacity to store the received cell.

30. A supervision control method, comprising:

receiving a cell including a header field with an identified virtual connection;

storing a plurality of bandwidth data which are pre-assigned to a plurality of sources of cells, and are stored at memory addresses, each of the memory addresses being operatively accessed based on one of a plurality of identified virtual connections;

monitoring a transmission rate on the identified virtual connection of a received cell;

comparing the transmission rate with the bandwidth data stored at the memory address corresponding to the identified virtual connection of the received cell; and

marking the received cell to indicate a higher cell loss priority when the monitored transmission rate of the received cell exceeds a rate corresponding to the bandwidth data.

31. A supervision control method according to claim 30, wherein said monitoring step comprises counting a number of the received cells having the same identified virtual connection in a predetermined duration unit.

32. A supervision control method according to claim 30, further comprising discarding the received cell which has been marked to indicate a higher cell loss priority when a buffer has less capacity than an operative capacity for buffering the received cell.

33. A supervision control method, comprising:

receiving a cell including a header field with an identified virtual connection and a bit indicating a cell loss priority;

storing a plurality of bandwidth data which are pre-assigned to a plurality of sources of cells, and are stored at memory addresses, each of the memory addresses being operatively accessed based on one of a plurality of identified virtual connections;

monitoring a transmission rate on the identified virtual connection of a received cell;

comparing the transmission rate with the bandwidth data stored at the memory address corresponding to the identified virtual connection of the received cell; and

marking the bit to indicate a higher cell loss priority when the monitored transmission rate of the received cell exceeds a rate corresponding to the bandwidth data.

34. A supervision control method according to claim 33, wherein said monitoring step comprises counting a number of the received cells having the same identified virtual connection in a predetermined duration unit.

35. A supervision control method according to claim 33, further comprising discarding the received cell which has been marked to indicate a higher cell loss priority when a buffer has less capacity than an operative capacity for buffering the received cell.

36. A supervision control method in which cells, each including a header field with an identified virtual connection and a bit indicating a cell loss priority, are received, comprising:

storing a plurality of bandwidth data which are pre-assigned to sources of the cells, and are stored at memory addresses, each of the memory addresses being operatively accessed based on one of a plurality of identified virtual connections;

monitoring a transmission rate on the identified virtual connection of a received cell;

comparing the transmission rate with the bandwidth data stored at the memory address corresponding to the identified virtual connection of the received cell; and

marking the bit to indicate a higher cell loss priority when the monitored transmission rate of the received cell exceeds a rate corresponding to the bandwidth data.

37. A supervision control method according to claim 36, wherein said monitoring comprises counting a number of the received cells having the same identified virtual connection in a predetermined duration unit.

38. A supervision control method according to claim 36, further comprising discarding the received cell which has been marked to indicate a higher cell loss priority when a buffer has less capacity than an operative capacity for buffering the received cell.

39. A switching system which receives a cell including a header field with an identified virtual connection, comprising:

a supervisor, including:

a memory to store a plurality of bandwidth data which are pre-assigned to sources of cells, and are stored at memory addresses, each of the memory addresses being operatively accessed based on one of a plurality of identified virtual connections;

a cell counter to monitor a transmission rate on the identified virtual connection specified by a received cell;

a comparator to compare the monitored transmission rate of said cell counter with the bandwidth data stored at a memory address corresponding to the identified virtual connection of the received cell; and

a judge circuit to mark the received cell to indicate a higher cell loss priority when the monitored transmission rate exceeds a rate corresponding to the bandwidth data; and

a switch to direct the cell from said supervisor to the identified virtual connection.

40. A switching system according to claim 39, wherein said cell counter counts a number of the received cells having the same identified virtual connection in a predetermined duration unit.

41. A switching system according to claim 39, further comprising a discard circuit to discard the received cell which has been marked to indicate a higher cell loss priority when a buffer has less capacity than an operative capacity to store the received cell.

42. A switching system which receives a cell including a header field with an identified virtual connection and a bit indicating a cell loss priority, comprising:

a supervisor, including:

a memory to store a plurality of bandwidth data which are pre-assigned to sources of cells, and are stored at memory addresses, each of the memory addresses being operatively accessed based on one of a plurality of identified virtual connections;

a cell counter to monitor a transmission rate on the identified virtual connection of a received cell;

a comparator to compare the monitored transmission rate of said cell counter with the bandwidth data stored at a memory address corresponding to the identified virtual connection of the received cell; and

a judge circuit to mark the bit to indicate a higher cell loss priority when the monitored transmission rate exceeds a rate corresponding to the bandwidth data; and

a switch to direct the cell from said supervisor to the identified virtual connection.

43. A switching system according to claim 42, wherein said cell counter counts a number of the received cells having the same identified virtual connection in a predetermined duration unit.

44. A switching system according to claim 42, further comprising a discard circuit to discard the received cell which has been marked to indicate a higher cell loss priority when a buffer has less capacity than an operative capacity to store the received cell.

45. A switching system, comprising:

an interface to receive a cell including a header field with an identified virtual connection and a bit indicating a cell loss priority;

a supervisor, including:

a memory to store a plurality of bandwidth data which are pre-assigned to sources of cells, and are stored at memory addresses, each of the memory addresses

being operatively accessed based on one of a plurality of identified virtual connections;

a cell counter to monitor a transmission rate on the identified virtual connection of a received cell;

a comparator to compare the monitored transmission rate of said cell counter with the bandwidth data stored at a memory address corresponding to the identified virtual connection of the received cell; and

a judge circuit to mark the bit to indicate a higher cell loss priority when the monitored transmission rate exceeds a rate corresponding to the bandwidth data; and

a switch to direct the cell from said supervisor to an output of the identified virtual connection.

46. A switching system according to claim 45, wherein said cell counter counts a number of the received cells having the same identified virtual connection in a predetermined duration unit.

47. A switching system according to claim 45, further comprising a discard circuit to discard the received cell which has been marked to indicate a higher cell loss priority when a buffer has less capacity than an operative capacity to store the received cell.

48. A switching system, comprising:

an interface to receive a cell including a header field with an identified virtual connection;

a supervisor, including:

a memory to store a plurality of bandwidth data which are pre-assigned to sources of cells, and are stored at memory addresses, each of the memory addresses being operatively accessed based on one of a plurality of identified virtual connections;

a cell counter to monitor a transmission rate on the identified virtual connection of a received cell;

a comparator to compare the monitored transmission rate of said cell counter with the bandwidth data stored at a memory address corresponding to the identified virtual connection of the received cell; and

a judge circuit to mark the received cell to indicate a higher cell loss priority when the monitored transmission rate exceeds a rate corresponding to the bandwidth data; and

a switch to direct the cell from said supervisor to an output of the identified virtual connection.

49. A switching system according to claim 48, wherein said cell counter counts a number of the received cells having the same identified virtual connection in a predetermined duration unit.

50. A switching system according to claim 48, further comprising a discard circuit to discard the received cell which has been marked to indicate a higher cell loss priority when a buffer has less capacity than an operative capacity to store the received cell.

51. A supervision control method in which a cell having a header field with an identified virtual connection, is received from a source, comprising:

storing a plurality of bandwidth data which are pre-assigned to sources of cells, and are stored at memory addresses, each of the memory addresses being operatively accessed based on one of a plurality of identified virtual connections; and

marking the received cell to indicate a higher cell loss priority when a transmission rate of the received cell exceeds a rate corresponding to the stored bandwidth data for the received cell.

52. A supervision control method according to claim 51, wherein said marking comprises counting the number of the received cells having the same identified virtual connection in a predetermined duration unit.

53. A supervision control method according to claim 51, further comprising discarding the received cell which has been marked to indicate a higher cell loss priority when a buffer has less capacity than an operative capacity for buffering the received cell.

54. A supervision control method according to claim 51, wherein said marking comprises:

monitoring a transmission rate on the identified virtual connection specified by a received cell; and

comparing the transmission rate with the bandwidth data stored at the memory address corresponding to the specified identified virtual connection.

55. A supervision control apparatus in which a cell having a header field with an identified virtual connection, is received from a source, comprising a supervisor including a memory to store a plurality of bandwidth data which are pre-assigned to sources of cells, and are stored at addresses thereof, each of the addresses being operatively accessed based on one of a plurality of identified virtual connections, said supervisor marking the received cell to indicate a higher cell loss priority when a transmission rate of the received cell exceeds a rate corresponding to the bandwidth data stored at an address of the memory corresponding to the identified virtual connection of the received cell.

56. A supervision control apparatus according to claim 55, wherein said supervisor includes a cell counter to count a number of the received cells having the same identified virtual connection in a predetermined duration unit.

57. A supervision control apparatus according to claim 55, further comprising a discard circuit to discard the received cell which has been marked to indicate a higher cell loss priority when a buffer has less capacity than an operative capacity to store the received cell.

58. A supervision control apparatus according to claim 55, wherein said supervisor further includes:

a cell counter to monitor a transmission rate on the identified virtual connection specified by a received cell;

a comparator, coupled to said memory and said cell counter, to compare the monitored transmission rate of said cell counter with the bandwidth data stored in said memory at the address corresponding to the identified virtual connection in the header field of the received cell; and

a judge circuit, coupled to said comparator, to mark the received cell to indicate a higher cell loss priority when the monitored transmission rate exceeds a rate corresponding to the bandwidth data.

59. A switching system which receives a cell including a header field with an identified virtual connection, comprising:

a supervisor including a memory to store a plurality of bandwidth data which are pre-assigned to sources of cells, and are stored at addresses thereof, each of the addresses being operatively accessed based on one of a plurality of identified virtual connections, said supervisor marking the received cell to indicate a higher cell loss priority when a transmission rate of the received cell exceeds a rate corresponding to the bandwidth data stored at the address of the memory corresponding to the identified virtual connection of the received cell; and

a switch to direct the cell from said supervisor to the identified virtual connection.

60. A switching system according to claim 59, wherein said supervisor includes a cell counter to count a number of received cells having the same identified virtual connection in a predetermined duration unit.

61. A switching system according to claim 59, further comprising a discard circuit to discard the received cell which has been marked to indicate a higher cell loss priority when a buffer has less capacity than an operative capacity to store the received cell.

62. A switching system which receives a cell including a header field with an identified virtual connection and a bit indicating a cell loss priority, comprising:

a supervisor including a memory to store a plurality of bandwidth data which are pre-assigned to sources of cells, and are stored at addresses thereof, each of the addresses being operatively accessed based on one of a plurality of identified virtual connections, said supervisor marking the received cell to indicate a higher cell loss priority when a transmission rate of the received cell exceeds a rate corresponding to the bandwidth data stored at the address of the memory corresponding to the identified virtual connection of the received cell; and

a switch to direct the cell from said supervisor to the identified virtual connection.

63. A switching system according to claim 62, wherein said supervisor includes a cell counter to count a number of the received cells having the same identified virtual connection in a predetermined duration unit.

64. A switching system according to claim 62, further comprising a discard circuit to discard the received cell which has been marked to indicate a higher cell loss priority when a buffer has less capacity than an operative capacity to store the received cell.

65. A switching system located along an identified virtual connection, comprising:

an interface to receive a cell including a header field with an identified virtual connection and a bit indicating a cell loss priority;

a supervisor including a memory to store a plurality of bandwidth data which are pre-assigned to sources of cells, and are stored at addresses thereof, each of the addresses being operatively accessed based on one of a plurality of identified virtual connections, said supervisor marking the bit to indicate a higher cell loss priority when the monitored transmission rate corresponding to the bandwidth data stored at an address of the memory corresponding to the identified virtual connection in the header field of the received cell; and

a switch, to direct the cell from said supervisor to an output of the identified virtual connection.

66. A switching system according to claim 65, wherein said supervisor includes a cell counter to count a number of the received cells having the same identified virtual connection in a predetermined duration unit.

67. A switching system according to claim 65, further comprising a discard circuit to discard the received cell which has been marked to indicate a higher cell loss priority when a buffer has less capacity than an operative capacity to store the received cell.

68. A switching system, comprising:

an interface to receive a cell including a header field with an identified virtual connection;

a supervisor including a memory to store a plurality of bandwidth data which are pre-assigned to sources of cells, and are stored at addresses thereof, each of the addresses being operatively accessed based on one of a plurality of identified virtual connections, said supervisor marking the received cell to indicate a higher cell loss priority when a transmission rate of the received cell exceeds a rate corresponding to the bandwidth data stored at an address of the memory corresponding to the identified virtual connection of the received cell; and

a switch to direct the cell from said supervisor to an output of the identified virtual connection.

69. A switching system according to claim 68, wherein said supervisor includes a cell counter to count a number of the received cells having the same identified virtual connection in a predetermined duration unit.

70. A switching system according to claim 68, further comprising a discard circuit to discard the received cell which has been marked to indicate a higher cell loss priority when a buffer has less capacity than an operative capacity to store the received cell.

71. A supervision control method, according to claim 1, wherein each of the cells is of fixed length.

72. A supervision control apparatus according to claim 4, wherein each of the cells is of fixed length.

73. A supervision control method, according to claim 9, wherein each of the cells is of fixed length.

74. A supervision control apparatus, according to claim 12, wherein each of the cells is of fixed length.

75. A supervision control apparatus, according to claim 15, wherein each of the cells is of fixed length.

76. A supervision control apparatus, according to claim 18, wherein each of the cells is of fixed length.

77. A supervision control apparatus, according to claim 21, wherein each of the cells is of fixed length.

78. A supervision control apparatus, according to claim 24, wherein each of the cells is of fixed length.

79. A supervision control apparatus, according to claim 27, wherein each of the cells is of fixed length.

80. A supervision control method, according to claim 30, wherein each of the cells is of fixed length.

81. A supervision control method, according to claim 33, wherein each of the cells is of fixed length.

82. A supervision control method, according to claim 36, wherein each of the cells is of fixed length.

83. A switching system, according to claim 39, wherein each of the cells is of fixed length.

84. A switching system, according to claim 42, wherein each of the cells is of fixed length.

85. A switching system, according to claim 45, wherein each of the cells is of fixed length.

86. A switching system, according to claim 48, wherein each of the cells is of fixed length.

87. A supervision control method, according to claim 51, wherein each of the cells is of fixed length.

88. A supervision control apparatus, according to claim 55, wherein each of the cells is of fixed length.

89. A switching system, according to claim 59, wherein each of the cells is of fixed length.

90. A switching system, according to claim 62, wherein each of the cells is of fixed length.

91. A switching system, according to claim 65, wherein each of the cells is of fixed length.

92. A switching system, according to claim 68, wherein each of the cells is of fixed length.

93. A supervision control method according to claim 9, wherein said storing comprises storing bandwidth data which is declared from the source of the received cell prior to transmitting the received cell from the source.

94. A supervision control apparatus according to claim 12, wherein said memory stores bandwidth data which is declared from the source of the received cell prior to transmitting the received cell from the source.

95. A supervision control apparatus according to claim 15, wherein said memory means stores bandwidth data which is declared from the source of the received cell prior to transmitting the received cell from the source.

96. A supervision control method according to claim 51, wherein said storing comprises storing bandwidth data which is declared from the source of the received cell prior to transmitting the received cell from the source.

97. A supervision control method, according to claim 55, wherein said memory stores bandwidth data which is declared from the source of the received cell prior to transmitting the received cell from the source.

98. A switching system, according to claim 59, wherein said memory stores bandwidth data which is declared from the source of the received cell prior to transmitting the received cell from the source.

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