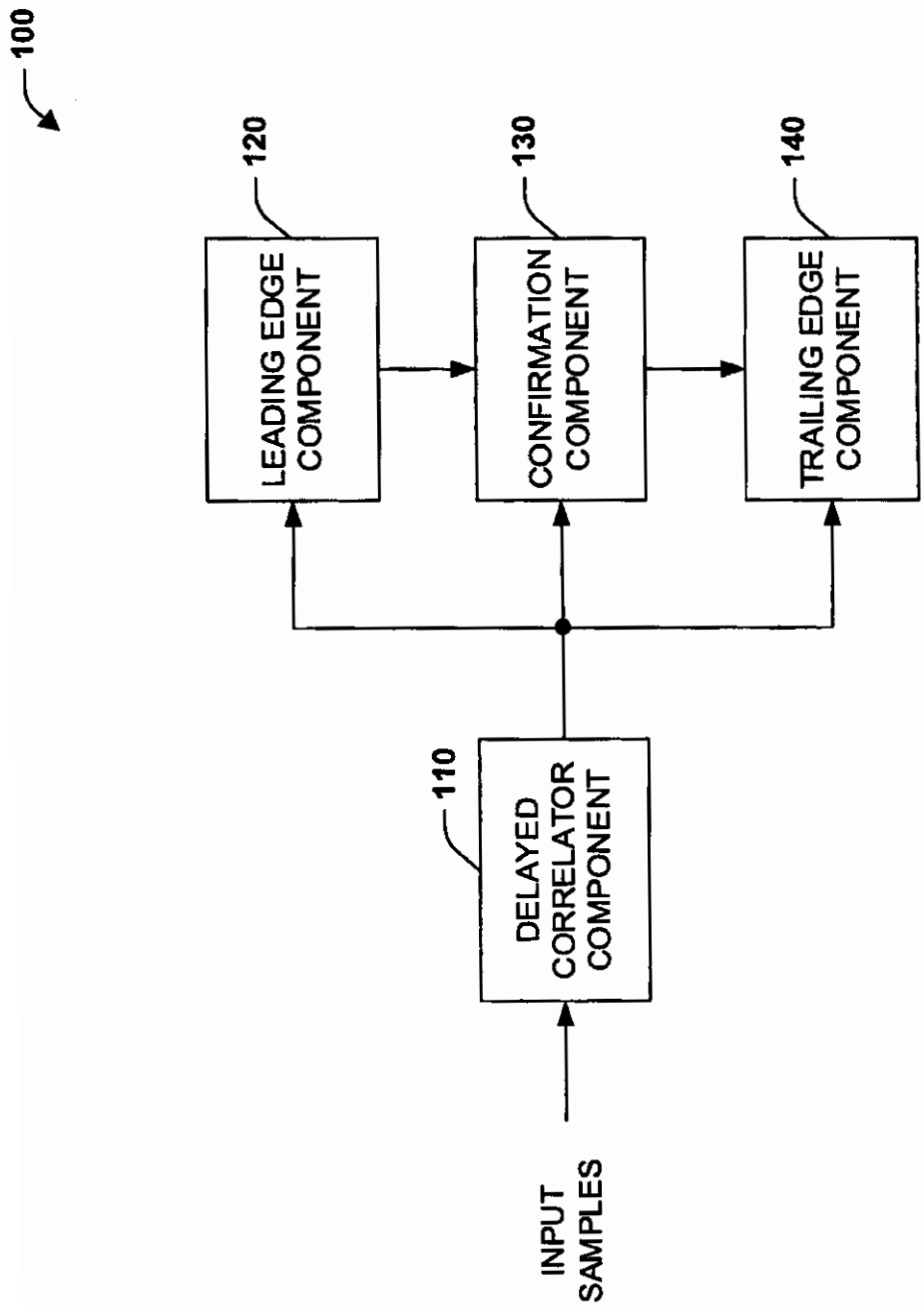

100
120
LEADING EDGE COMPONENT
130
CONFIRMATION COMPONENT
140
TRAILING EDGE COMPONENT
110
DELAYED CORRELATOR COMPONENT
INPUT SAMPLES

Fig. 1

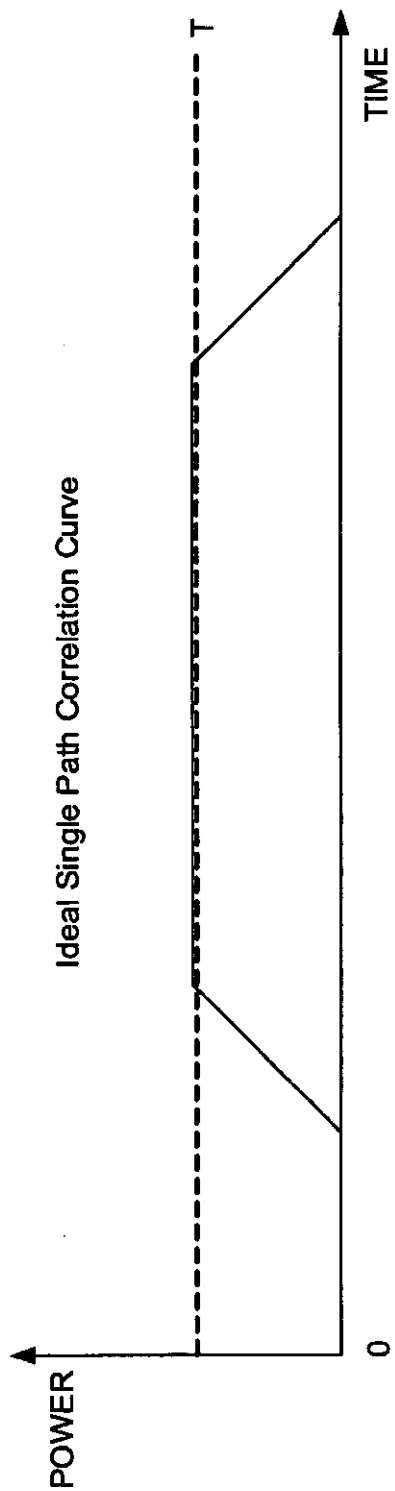

Ideal Single Path Correlation Curve
T
TIME
POWER
0

Fig. 2a

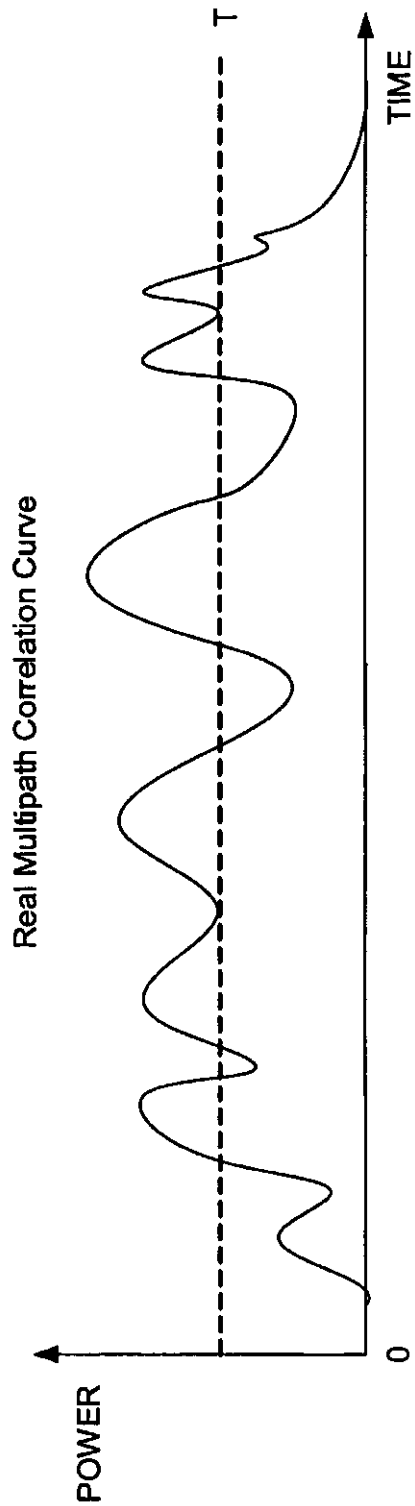

Real Multipath Correlation Curve
T
TIME
POWER
0

Fig. 2b

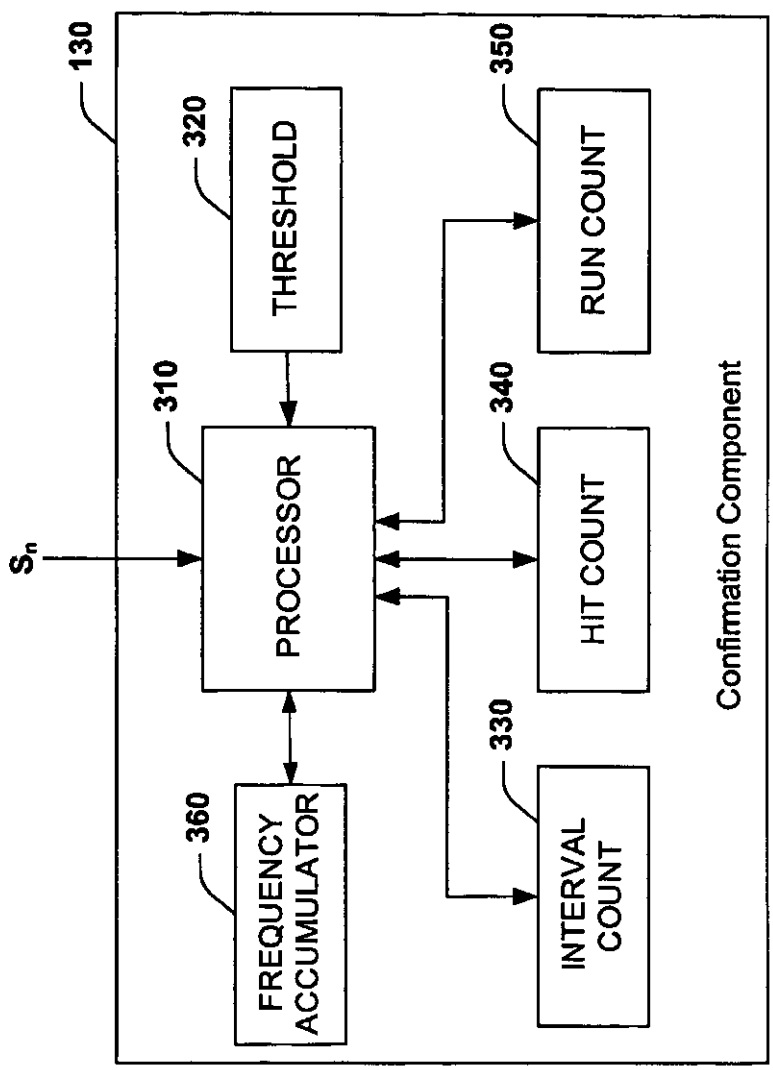

130
320
THRESHOLD
350
RUN COUNT
310
PROCESSOR
340
HIT COUNT
S_n
330
INTERVAL COUNT
360
FREQUENCY ACCUMULATOR
Confirmation Component

Fig. 3

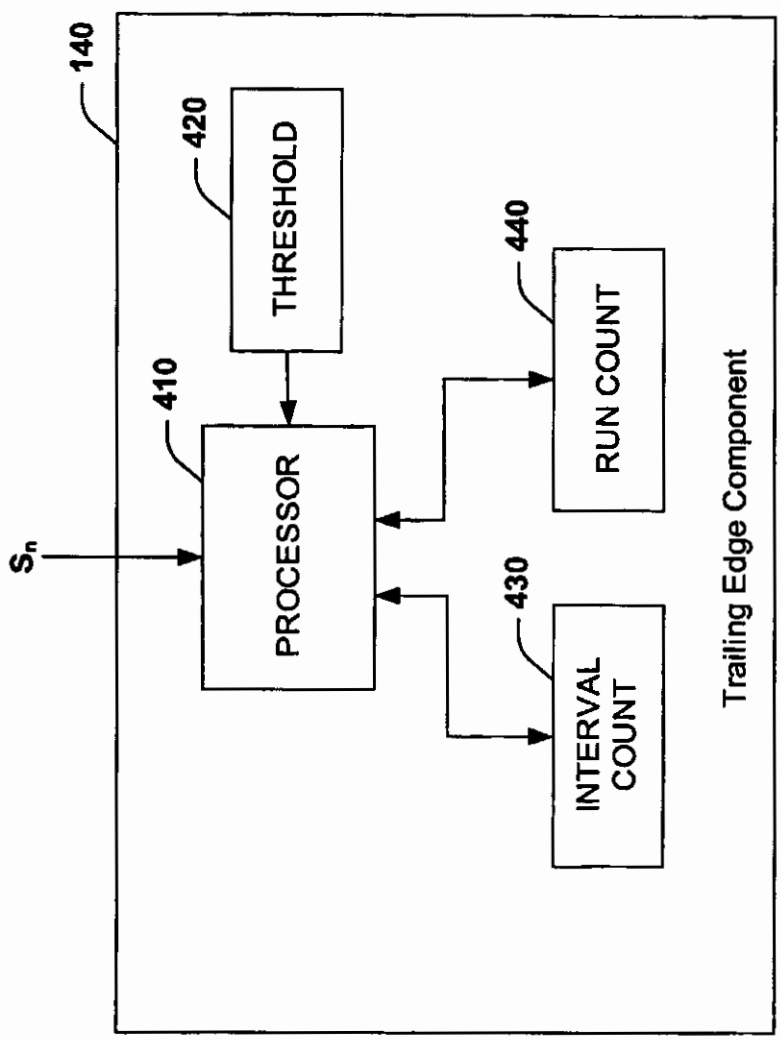

140
420
THRESHOLD
440
RUN COUNT
410
PROCESSOR
S_n
430
INTERVAL COUNT
Trailing Edge Component

Fig. 4

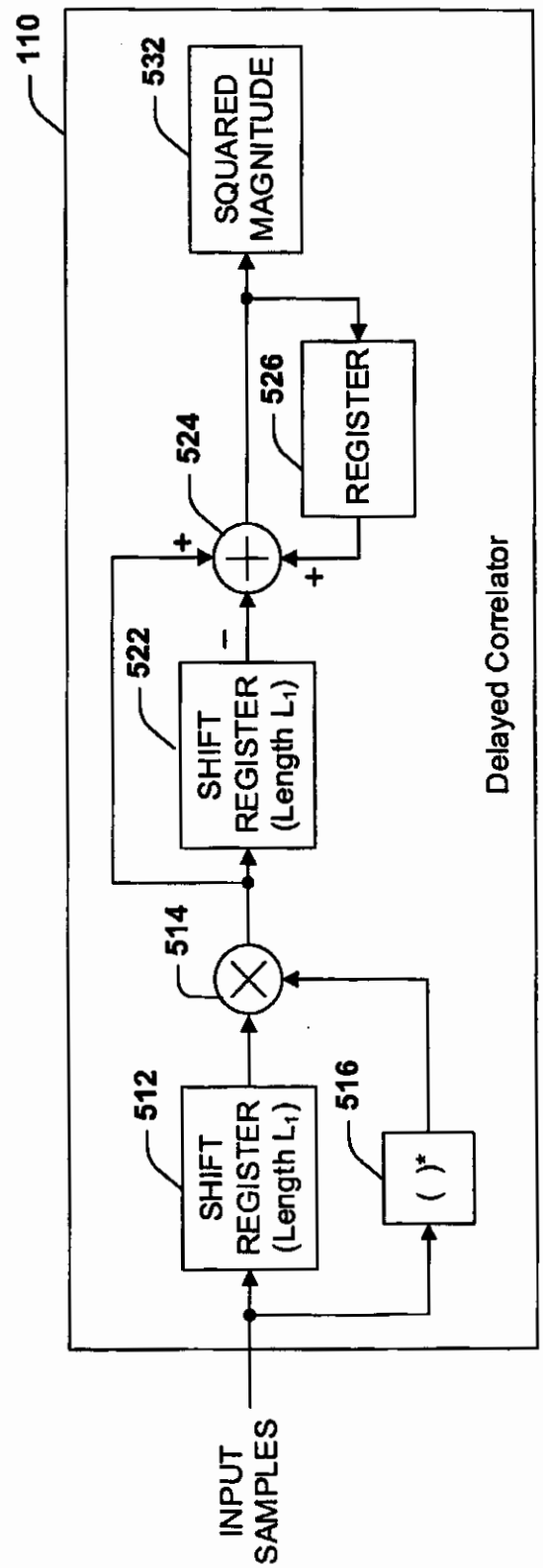

110
532
SQUARED MAGNITUDE
526
REGISTER
524
+
+
522
SHIFT REGISTER (Length L_1)
-
514
512
SHIFT REGISTER (Length L_1)
516
( )*
Delayed Correlator
INPUT SAMPLES

Fig. 5

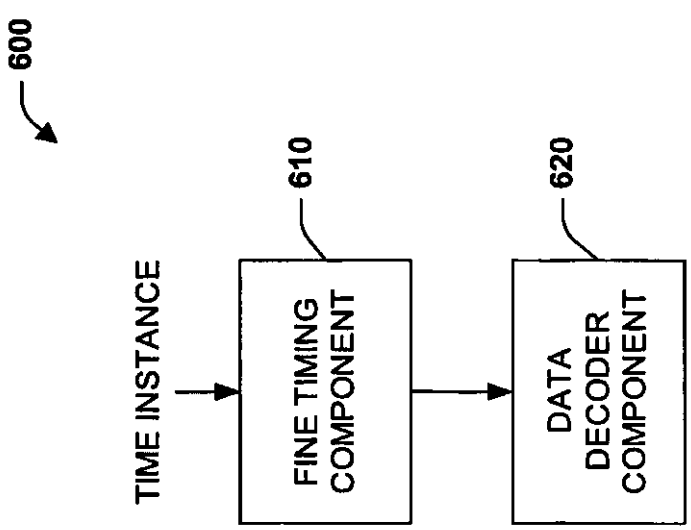

600
610
620
TIME INSTANCE
FINE TIMING COMPONENT
DATA DECODER COMPONENT

Fig. 6

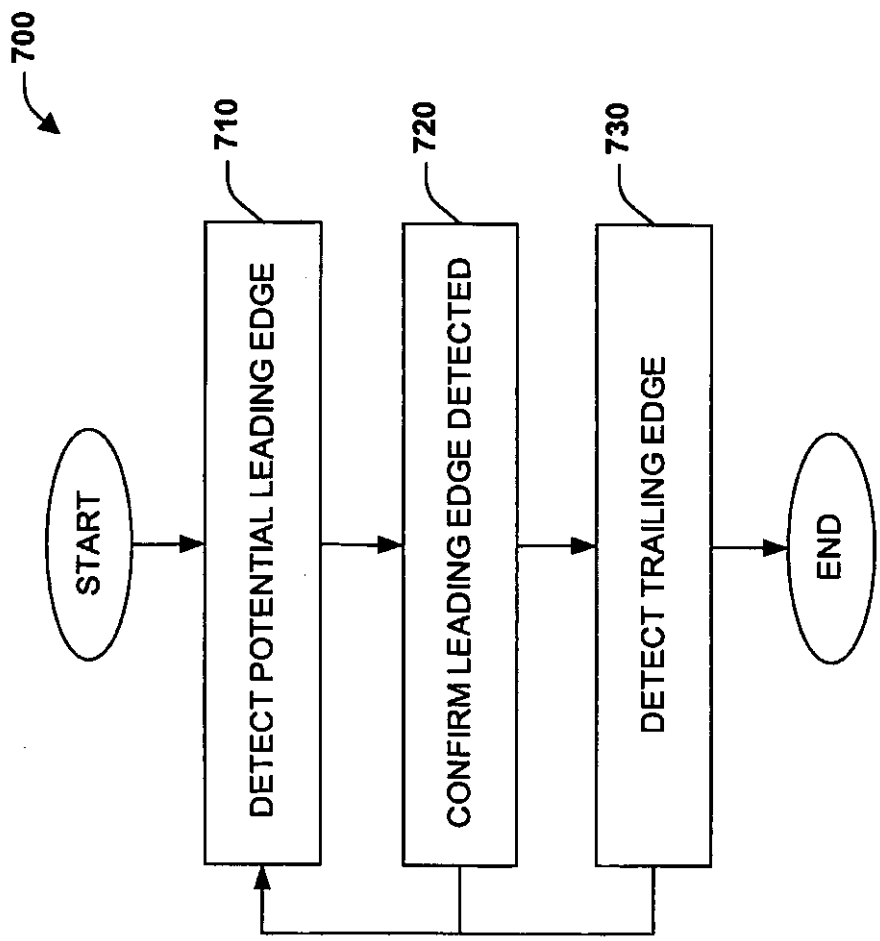

700
710
720
730
START
DETECT POTENTIAL LEADING EDGE
CONFIRM LEADING EDGE DETECTED
DETECT TRAILING EDGE
END

Fig. 7

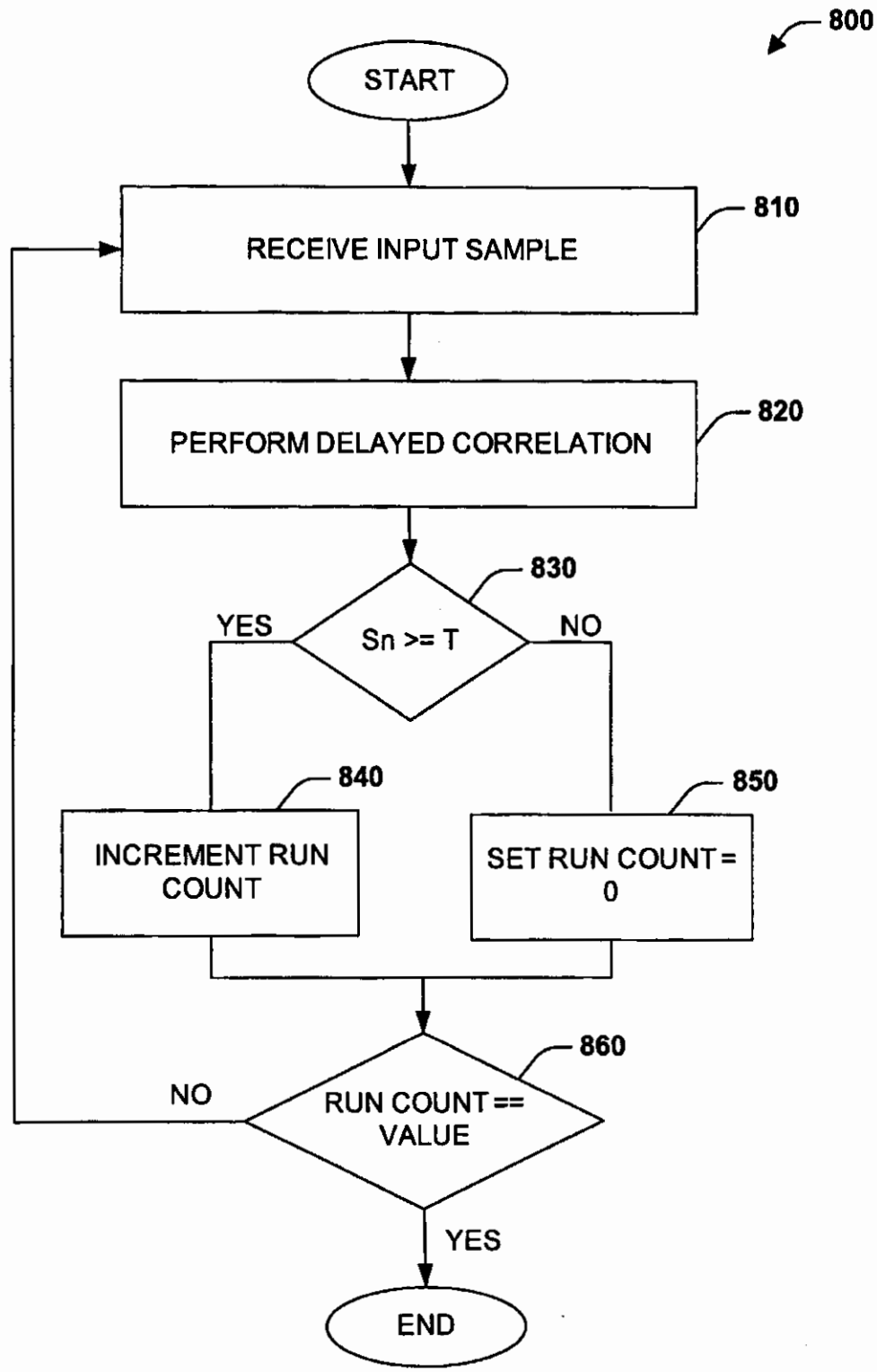

800
START
RECEIVE INPUT SAMPLE
810
PERFORM DELAYED CORRELATION
820
830
YES
Sn >= T
NO
840
850
INCREMENT RUN COUNT
SET RUN COUNT = 0
860
NO
RUN COUNT == VALUE
YES
END

Fig. 8

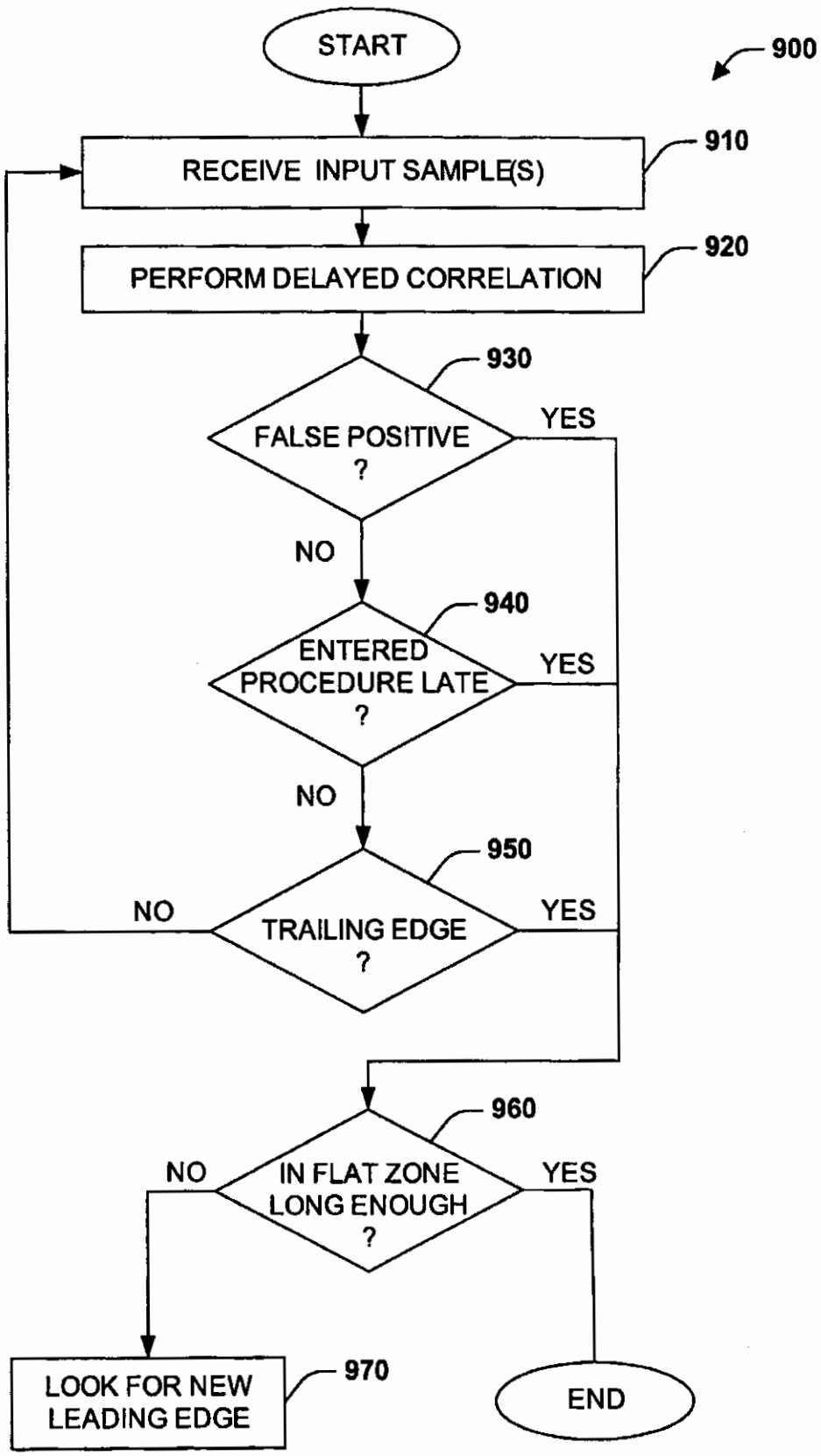

START
900
RECEIVE INPUT SAMPLE(S)
910
PERFORM DELAYED CORRELATION
920
930
FALSE POSITIVE ?
YES
NO
940
ENTERED PROCEDURE LATE ?
YES
NO
950
TRAILING EDGE ?
NO
YES
960
IN FLAT ZONE LONG ENOUGH ?
NO
YES
LOOK FOR NEW LEADING EDGE
970
END

Fig. 9

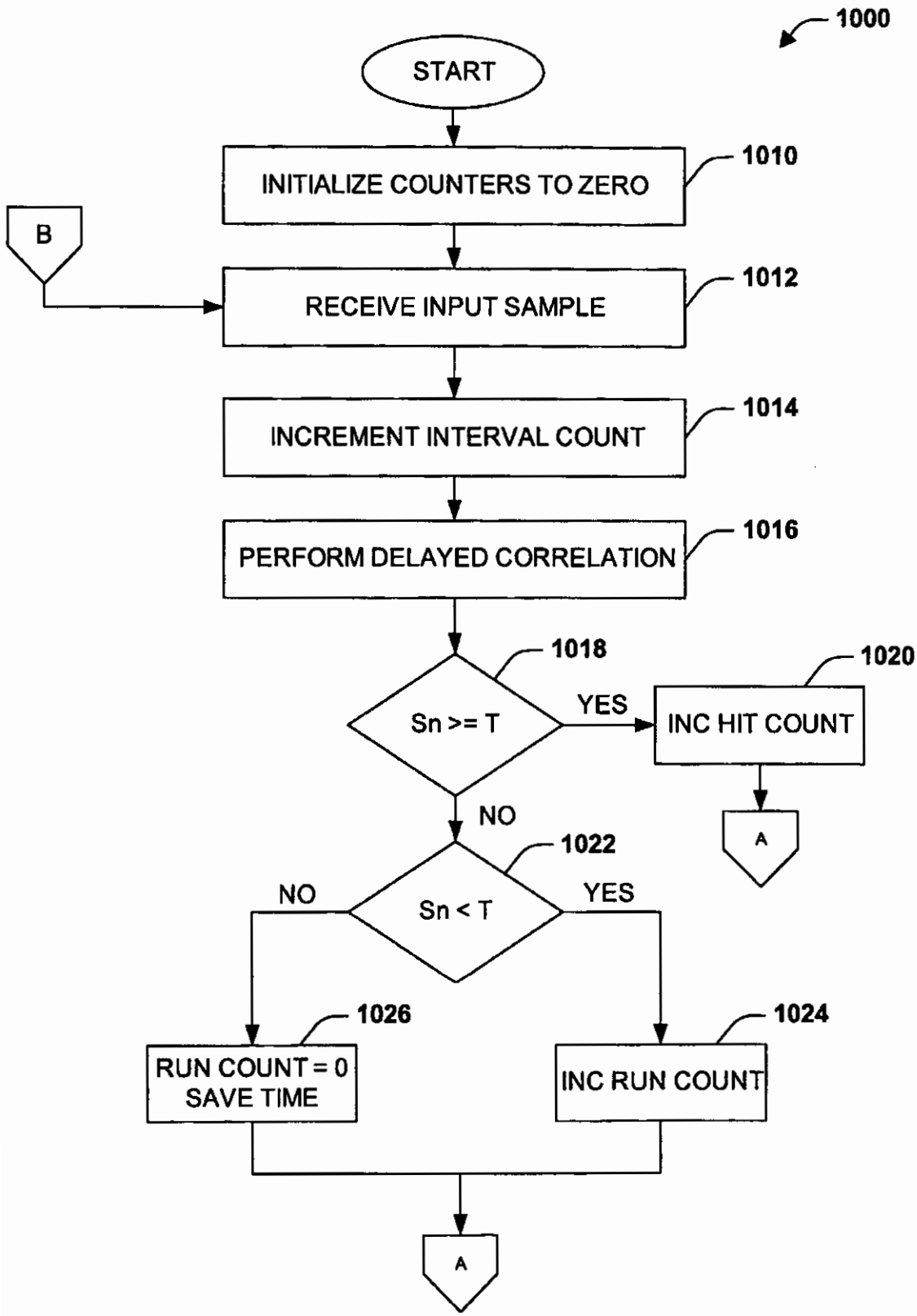

1000
START
INITIALIZE COUNTERS TO ZERO
1010
B
RECEIVE INPUT SAMPLE
1012
INCREMENT INTERVAL COUNT
1014
PERFORM DELAYED CORRELATION
1016
1018
Sn >= T
YES
1020
INC HIT COUNT
A
NO
1022
NO
Sn < T
YES
1026
1024
RUN COUNT = 0
SAVE TIME
INC RUN COUNT
A

Fig. 10a

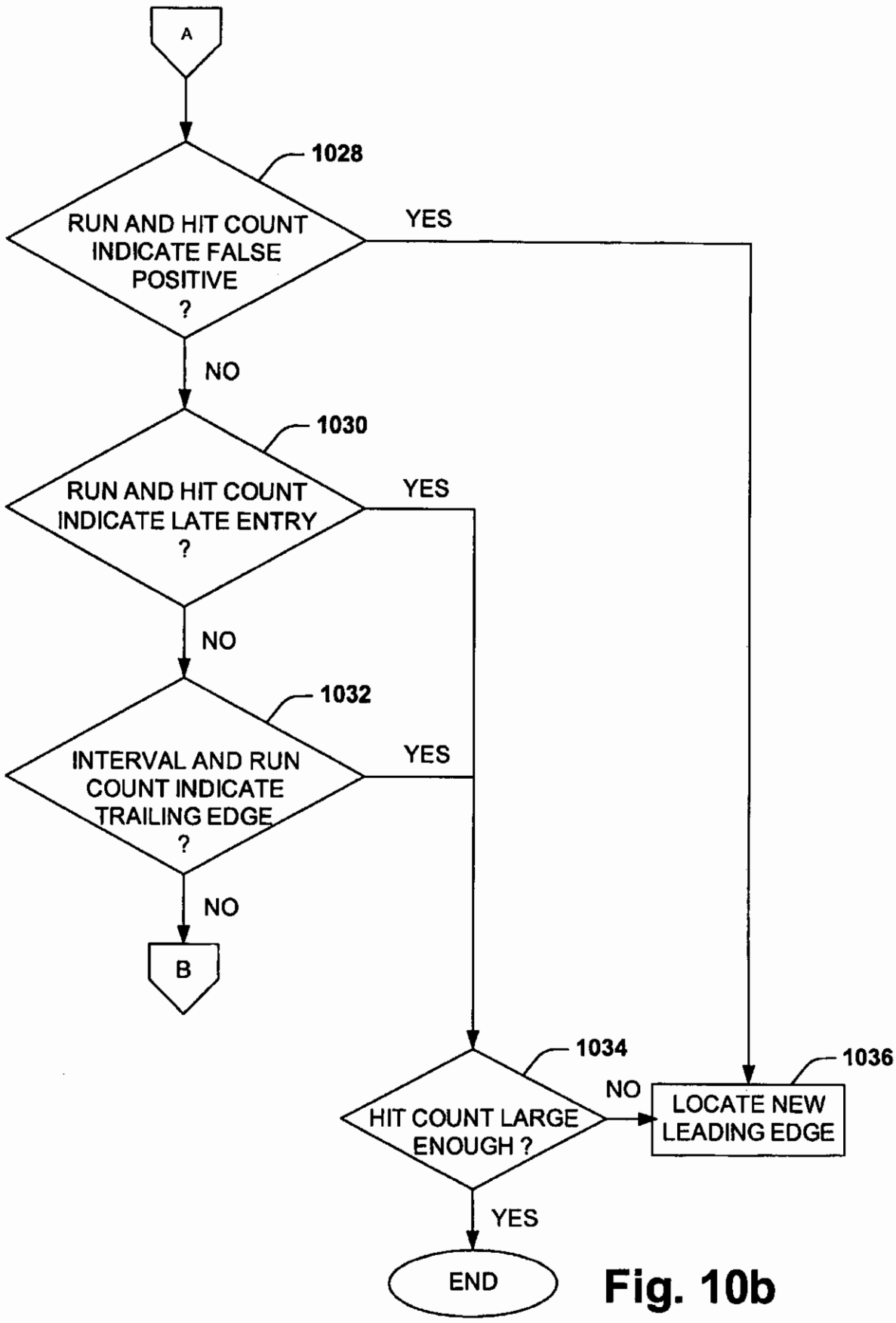

A
1028
RUN AND HIT COUNT INDICATE FALSE POSITIVE ?
YES
NO
1030
RUN AND HIT COUNT INDICATE LATE ENTRY ?
YES
NO
1032
INTERVAL AND RUN COUNT INDICATE TRAILING EDGE ?
YES
NO
B
1034
HIT COUNT LARGE ENOUGH ?
NO
1036
LOCATE NEW LEADING EDGE
YES
END

Fig. 10b

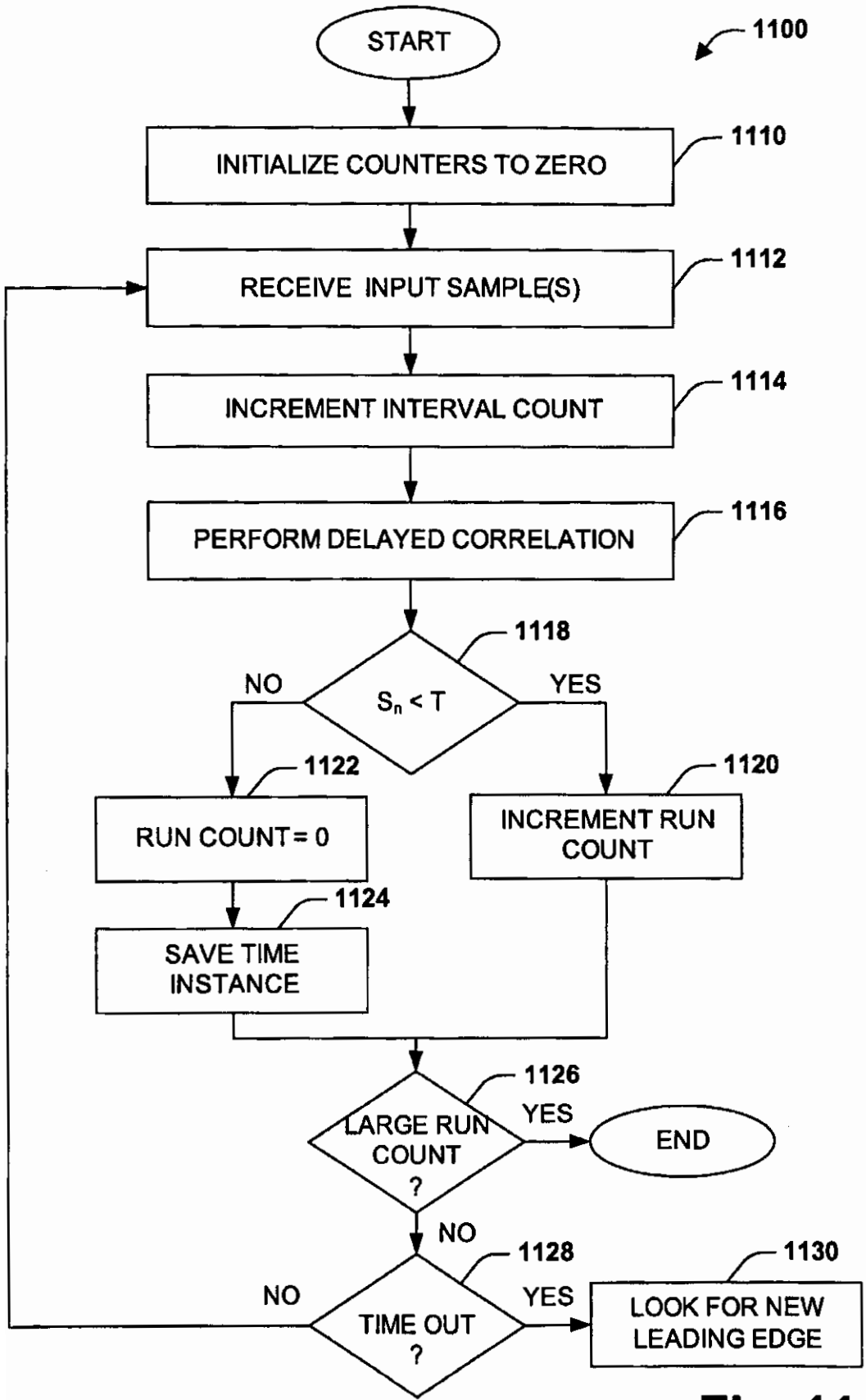

START
1100
INITIALIZE COUNTERS TO ZERO
1110
RECEIVE INPUT SAMPLE(S)
1112
INCREMENT INTERVAL COUNT
1114
PERFORM DELAYED CORRELATION
1116
1118
NO
$S_n < T$
YES
1122
1120
RUN COUNT = 0
INCREMENT RUN COUNT
1124
SAVE TIME INSTANCE
1126
LARGE RUN COUNT ?
YES
END
NO
1128
1130
NO
TIME OUT ?
YES
LOOK FOR NEW LEADING EDGE

Fig. 11

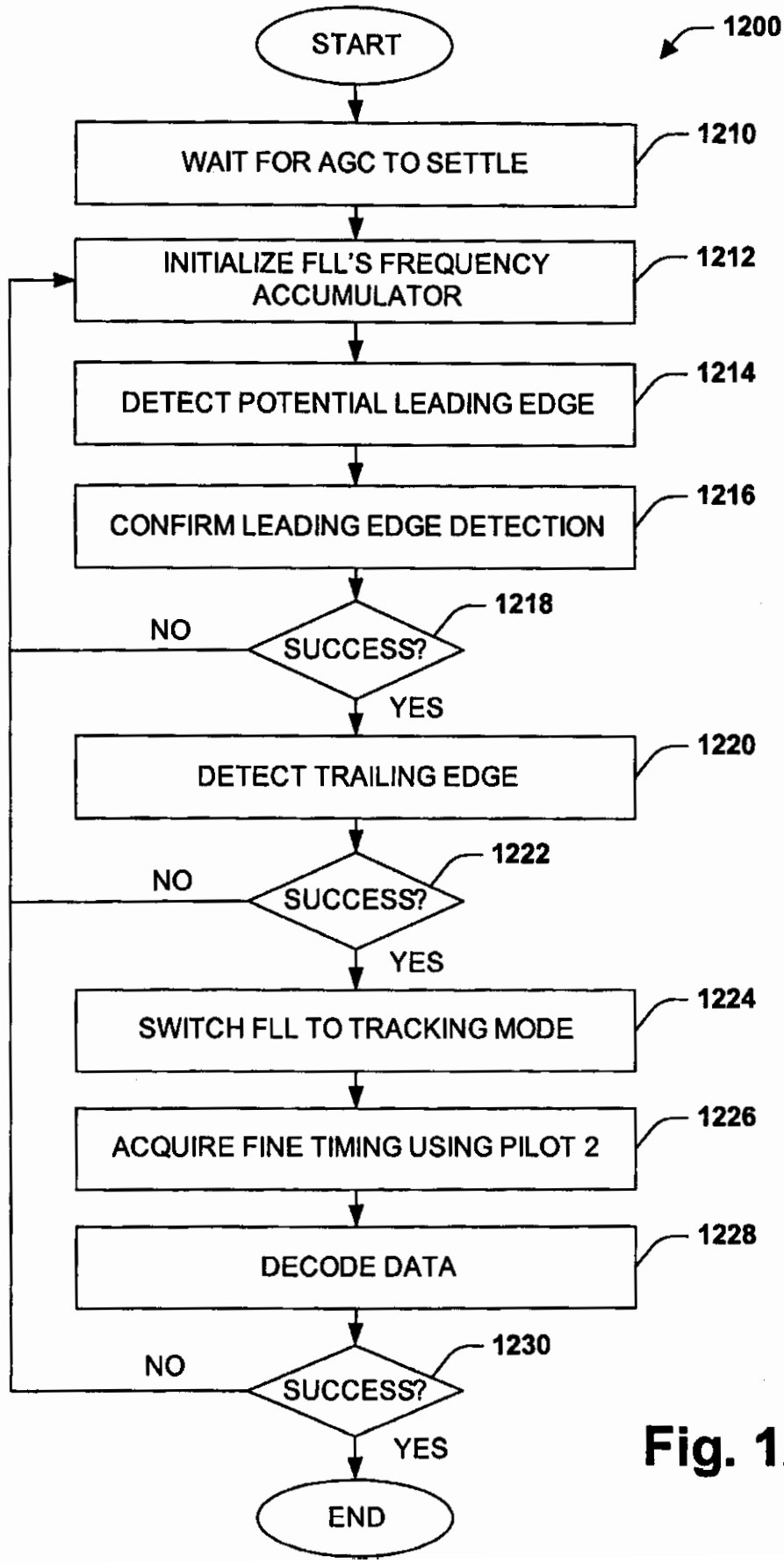

START
1200
WAIT FOR AGC TO SETTLE
1210
INITIALIZE FLL'S FREQUENCY ACCUMULATOR
1212
DETECT POTENTIAL LEADING EDGE
1214
CONFIRM LEADING EDGE DETECTION
1216
SUCCESS?
1218
NO
YES
DETECT TRAILING EDGE
1220
SUCCESS?
1222
NO
YES
SWITCH FLL TO TRACKING MODE
1224
ACQUIRE FINE TIMING USING PILOT 2
1226
DECODE DATA
1228
SUCCESS?
1230
NO
YES
END

Fig. 12

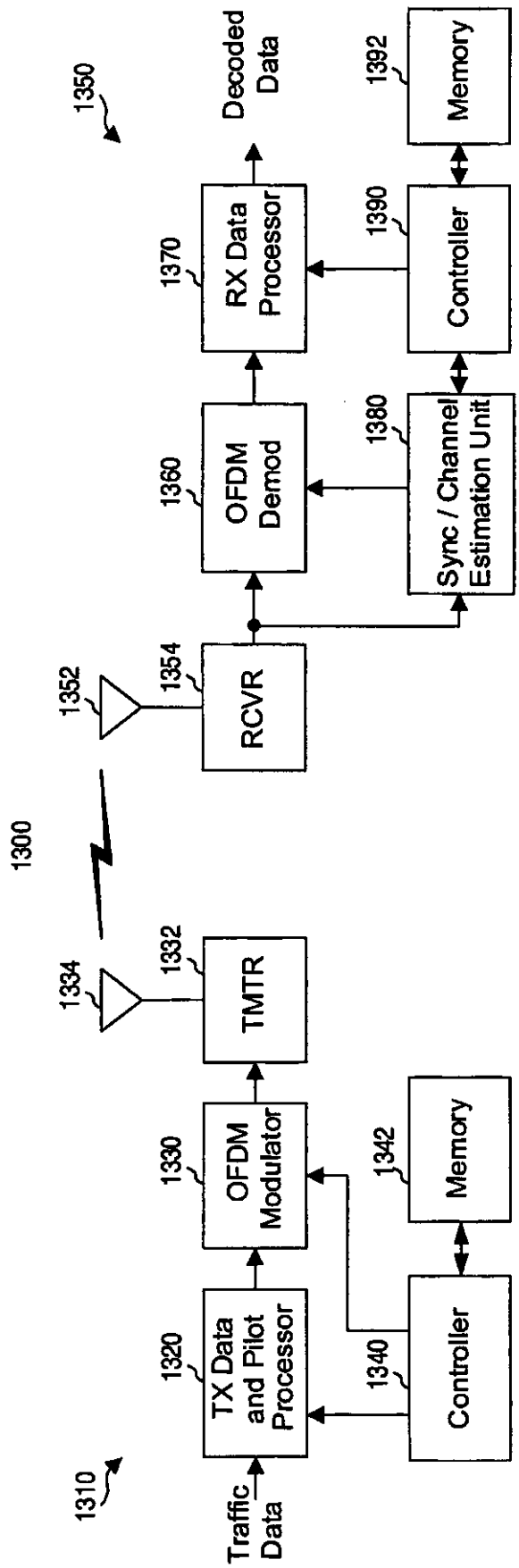

1310
Traffic Data
1320
TX Data and Pilot Processor
1330
OFDM Modulator
1332
TMTR
1334
1340
Controller
1342
Memory
1300
1350
1352
1354
RCVR
1360
OFDM Demod
1370
RX Data Processor
Decoded Data
1380
Sync / Channel Estimation Unit
1390
Controller
1392
Memory

Fig. 13

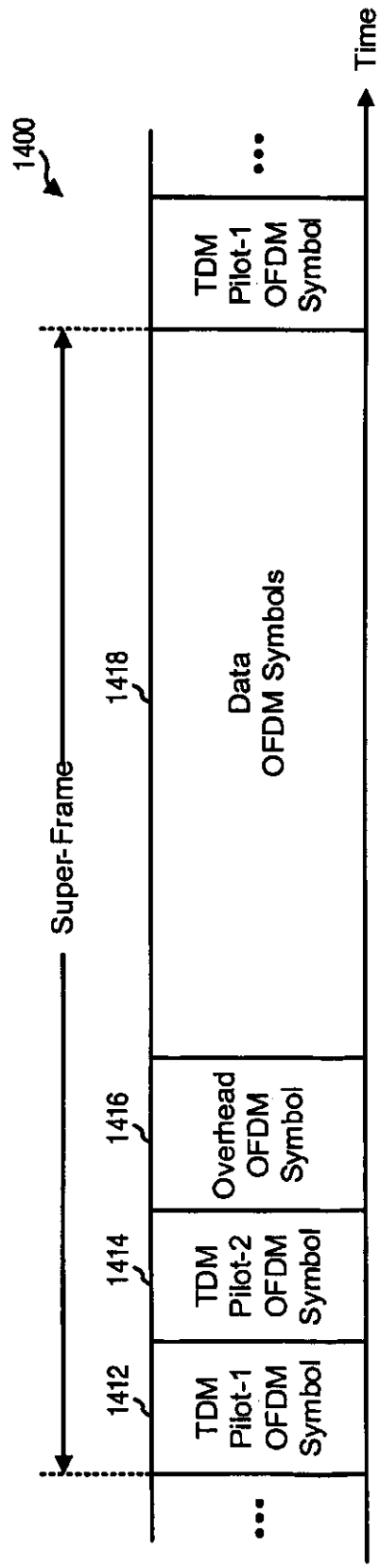

1400
Super-Frame
1412
TDM Pilot-1 OFDM Symbol
1414
TDM Pilot-2 OFDM Symbol
1416
Overhead OFDM Symbol
1418
Data OFDM Symbols
TDM Pilot-1 OFDM Symbol
Time

Fig. 14

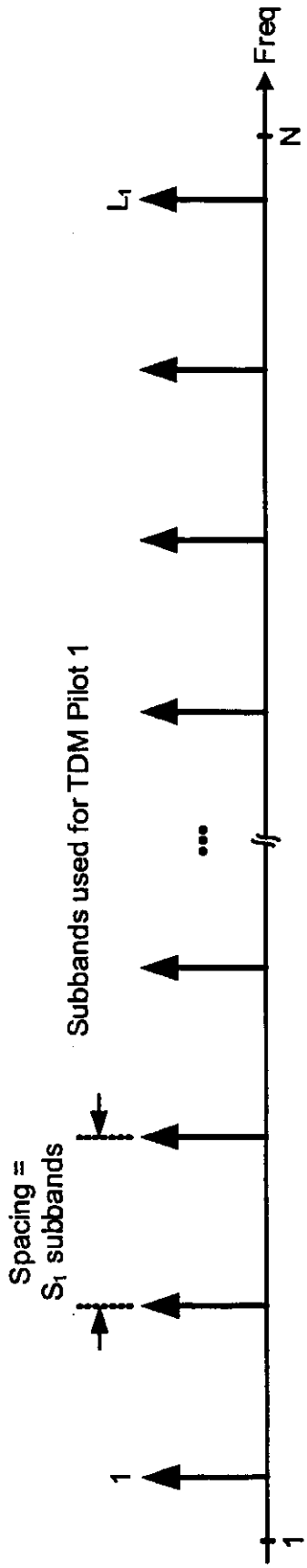


Fig. 15a

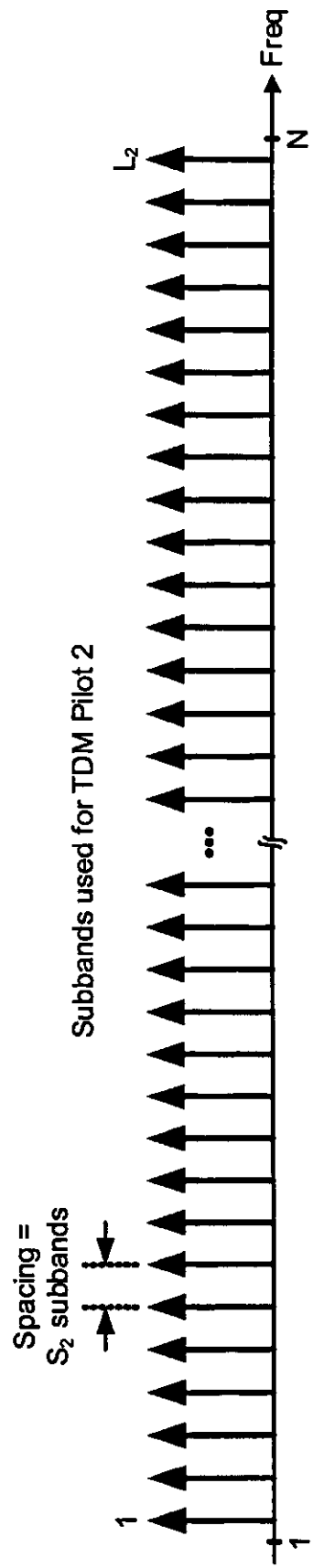


Fig. 15b

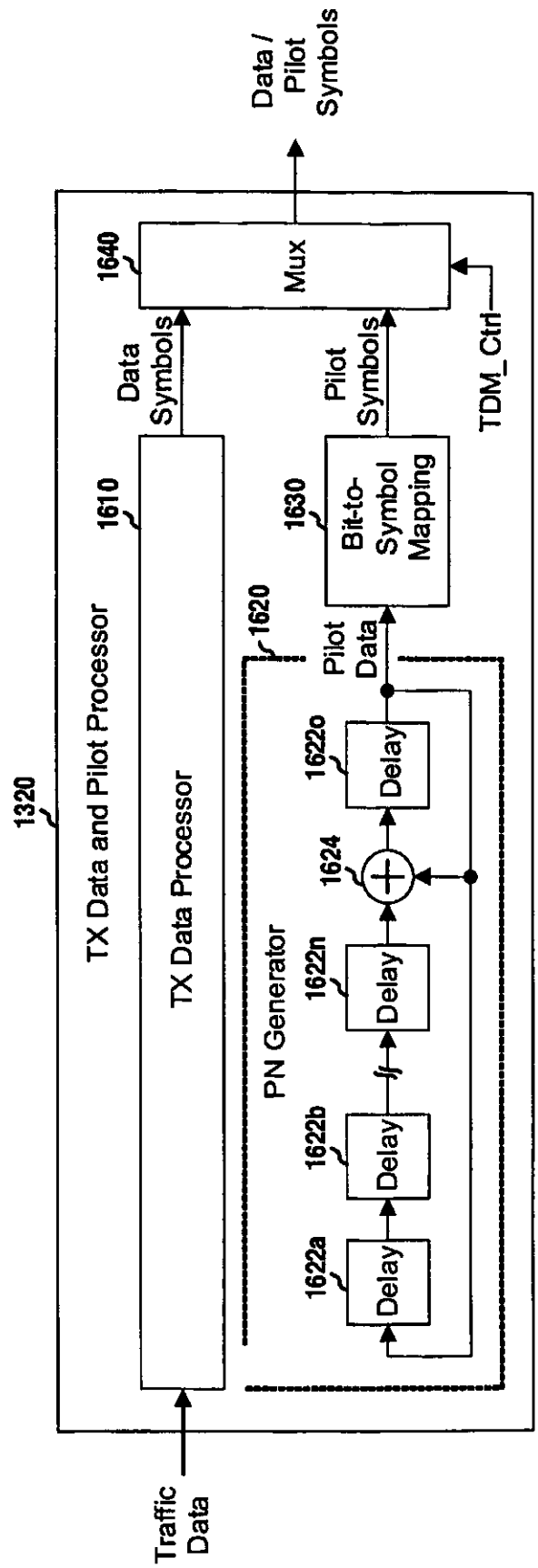

Traffic Data
1320
TX Data and Pilot Processor
TX Data Processor
1610
Data Symbols
1640
Mux
Data / Pilot Symbols
TDM_Ctrl
1630
Bit-to-Symbol Mapping
Pilot Symbols
1620
Pilot Data
PN Generator
1622a
Delay
1622b
Delay
1622n
Delay
1624
1622o
Delay

Fig. 16

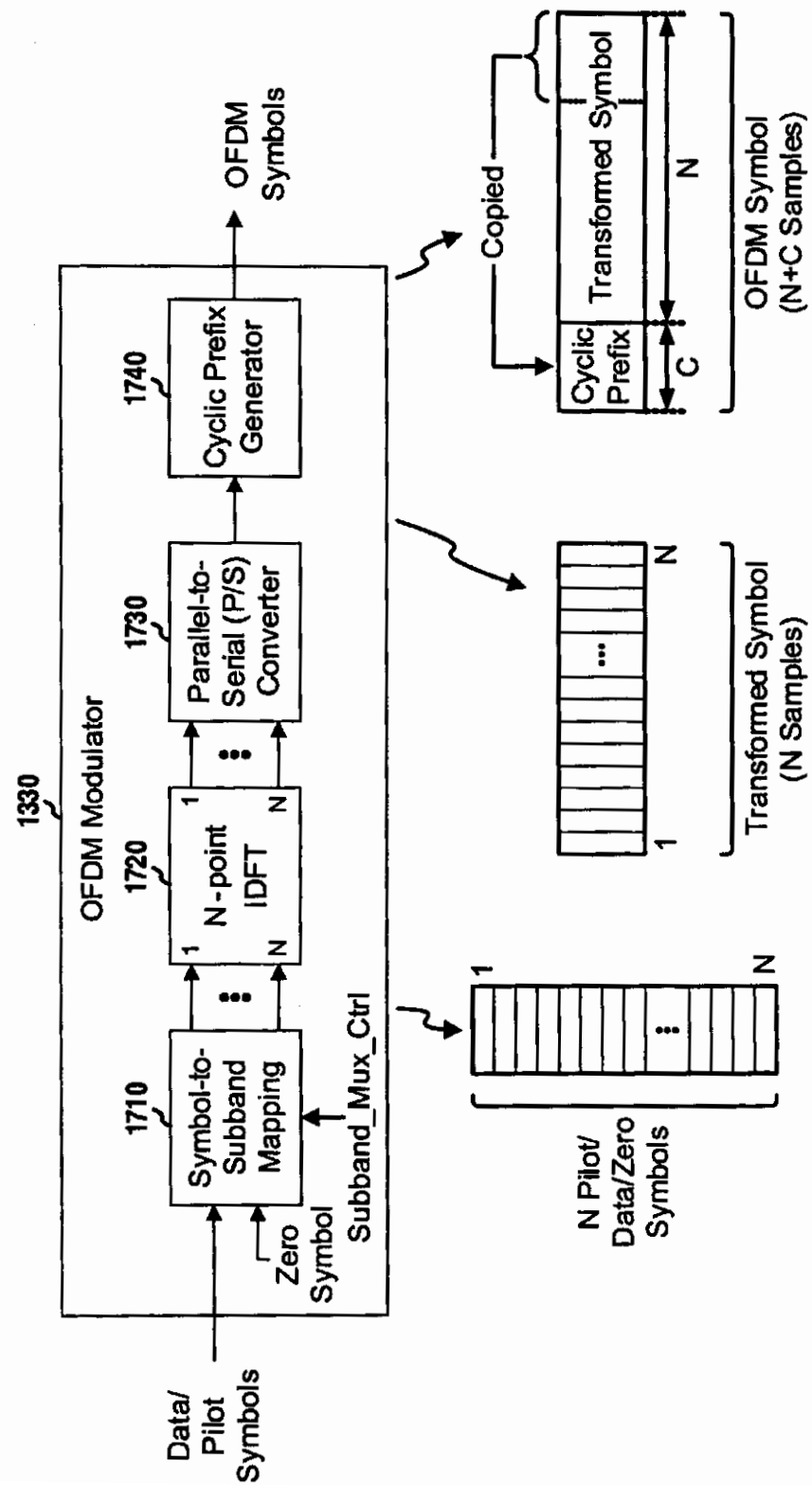

1330
OFDM Modulator
1710
Symbol-to-Subband Mapping
1720
N-point IDFT
1730
Parallel-to-Serial (P/S) Converter
1740
Cyclic Prefix Generator
Data/ Pilot Symbols
Zero Symbol
Subband_Mux_Ctrl
OFDM Symbols
N Pilot/ Data/Zero Symbols
Transformed Symbol (N Samples)
Copied
Cyclic Prefix
Transformed Symbol
C
N
OFDM Symbol (N+C Samples)

Fig. 17

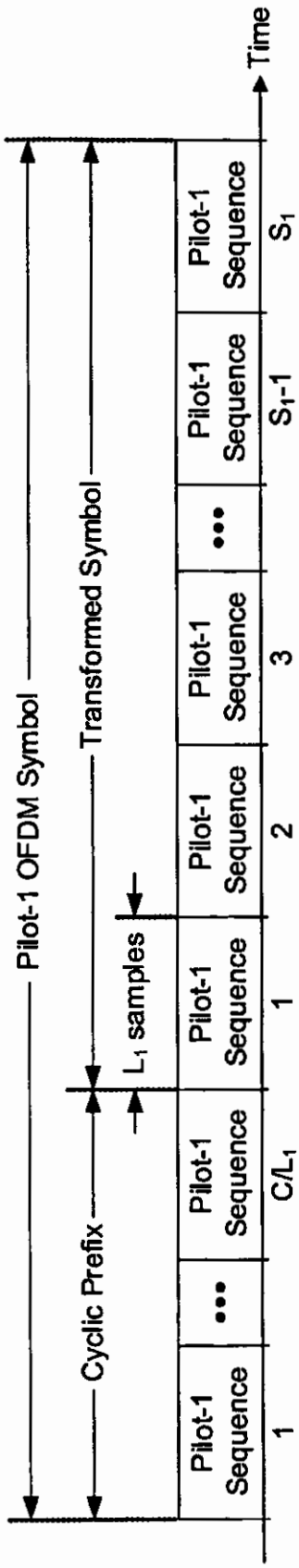


Fig. 18a

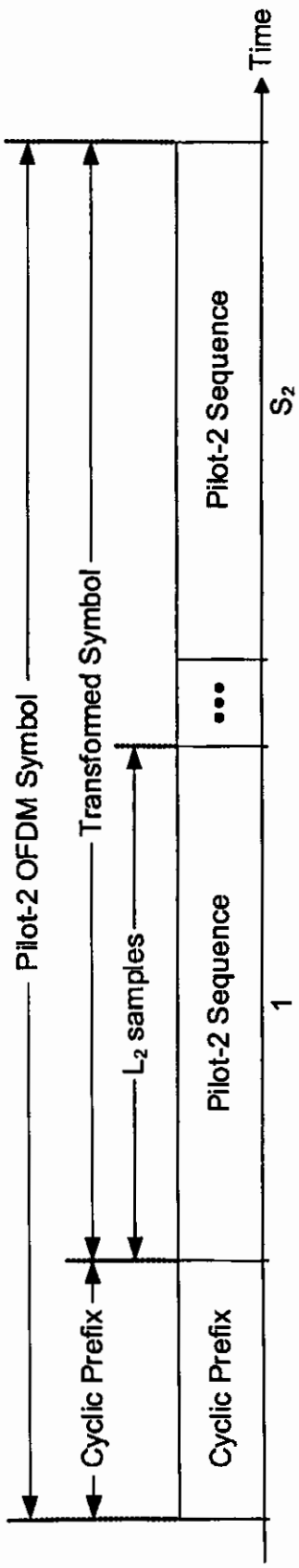


Fig. 18b

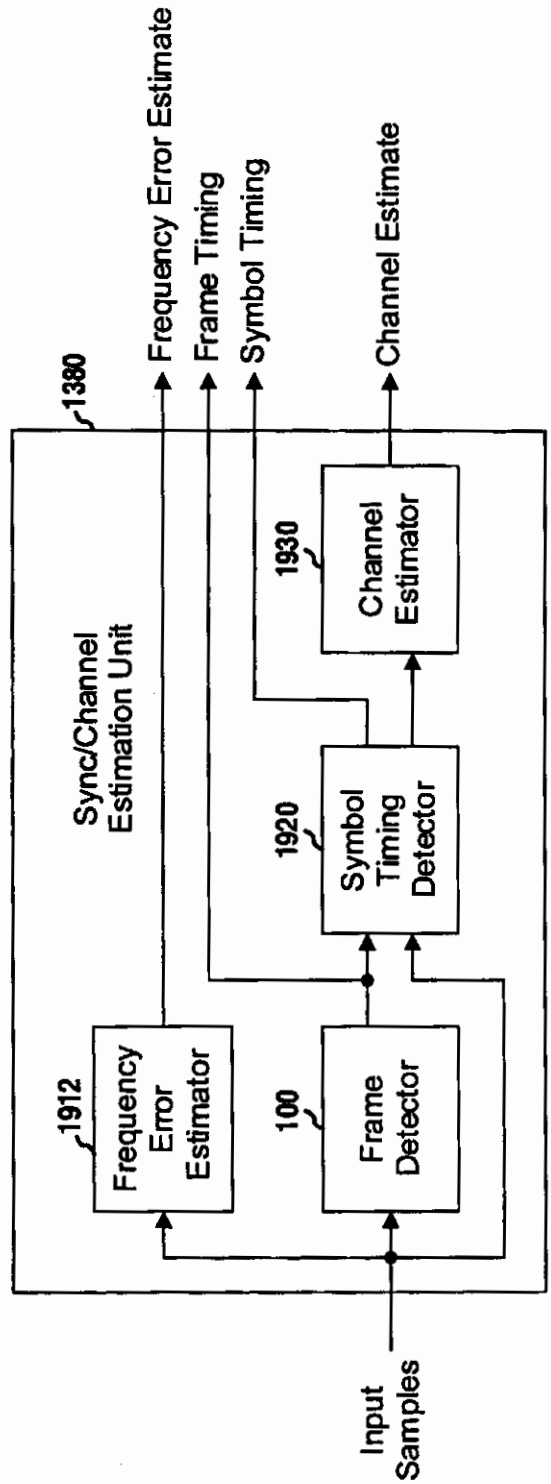

Frequency Error Estimate
Frame Timing
Symbol Timing
Channel Estimate
1380
Sync/Channel Estimation Unit
1930
Channel Estimator
1920
Symbol Timing Detector
1912
Frequency Error Estimator
100
Frame Detector
Input Samples

Fig. 19

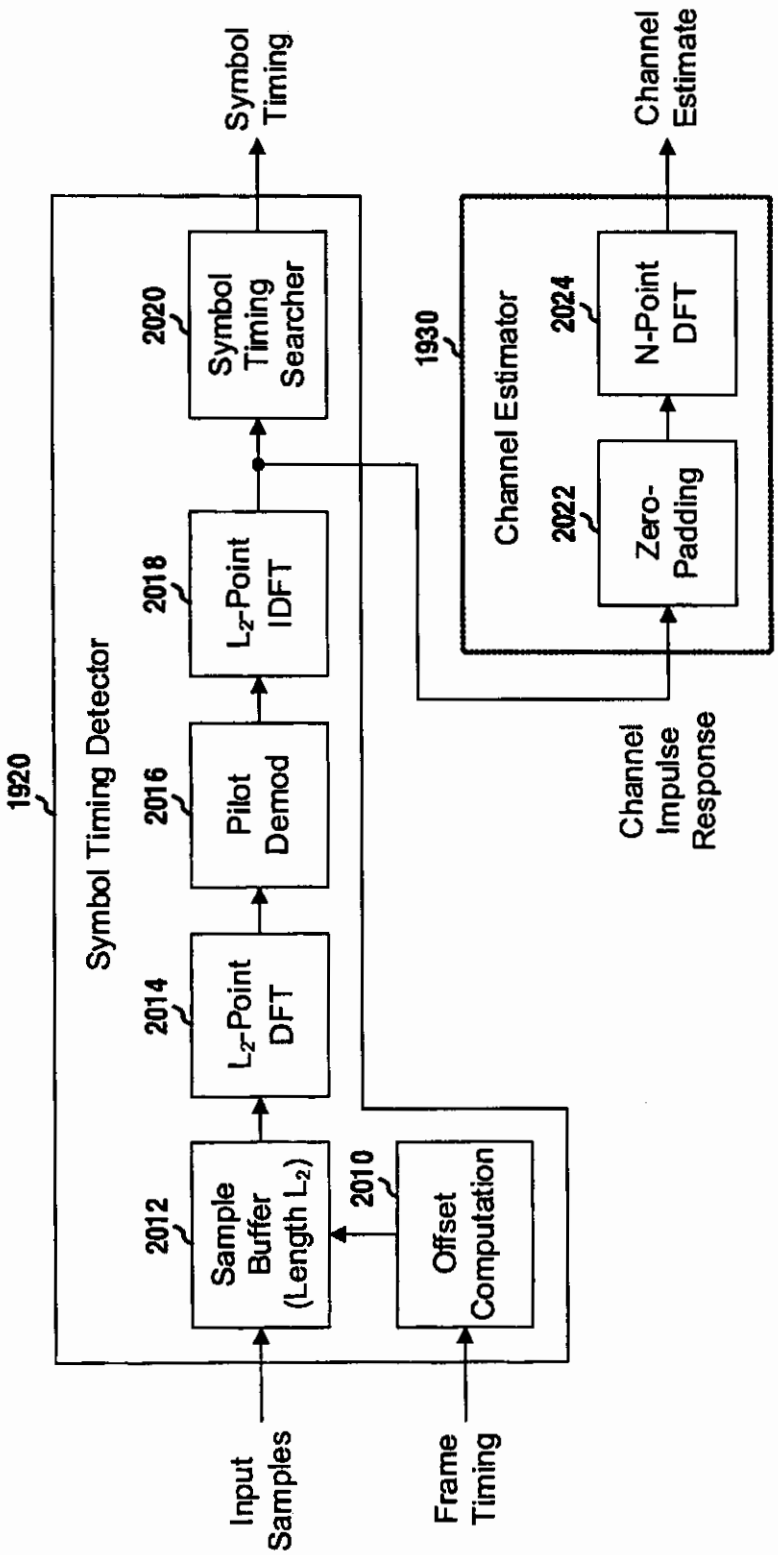

Symbol Timing
Channel Estimate
1920
Symbol Timing Detector
2020
Symbol Timing Searcher
1930
Channel Estimator
2024
N-Point DFT
2018
L_2-Point IDFT
2022
Zero-Padding
2016
Pilot Demod
2014
L_2-Point DFT
2012
Sample Buffer (Length L_2)
2010
Offset Computation
Channel Impulse Response
Input Samples
Frame Timing

Fig. 20

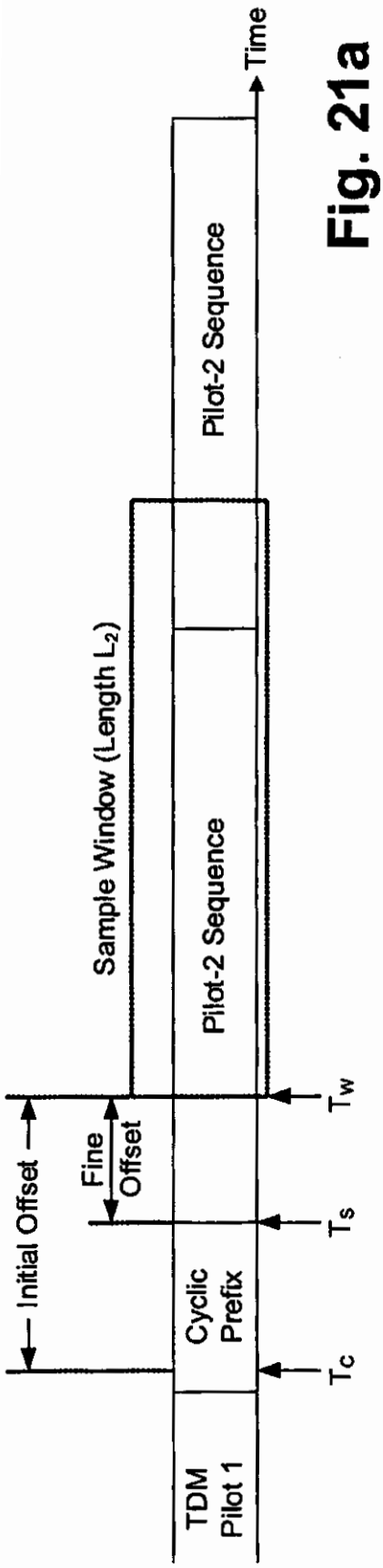


Fig. 21a

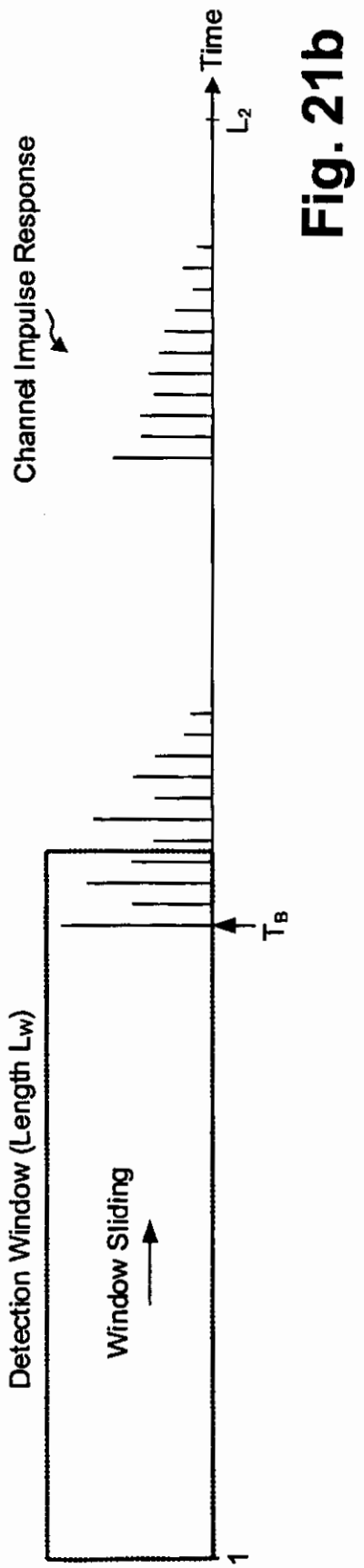


Fig. 21b

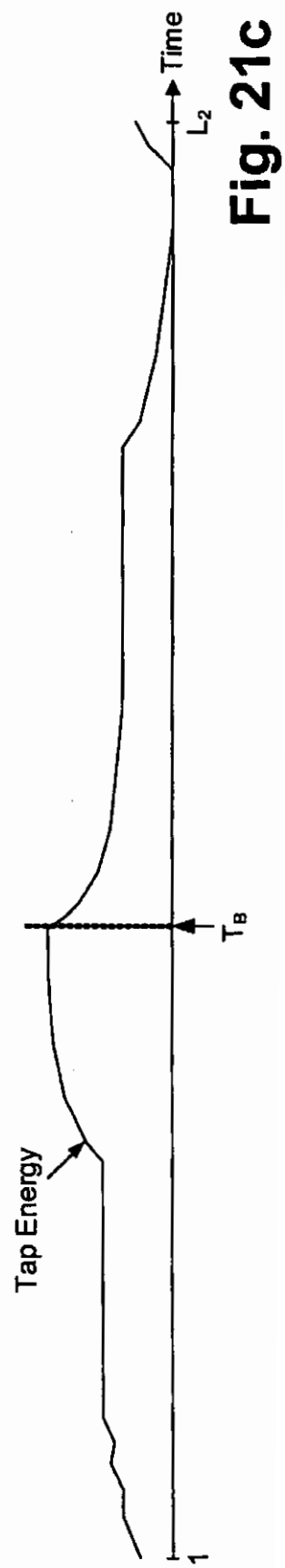


Fig. 21c

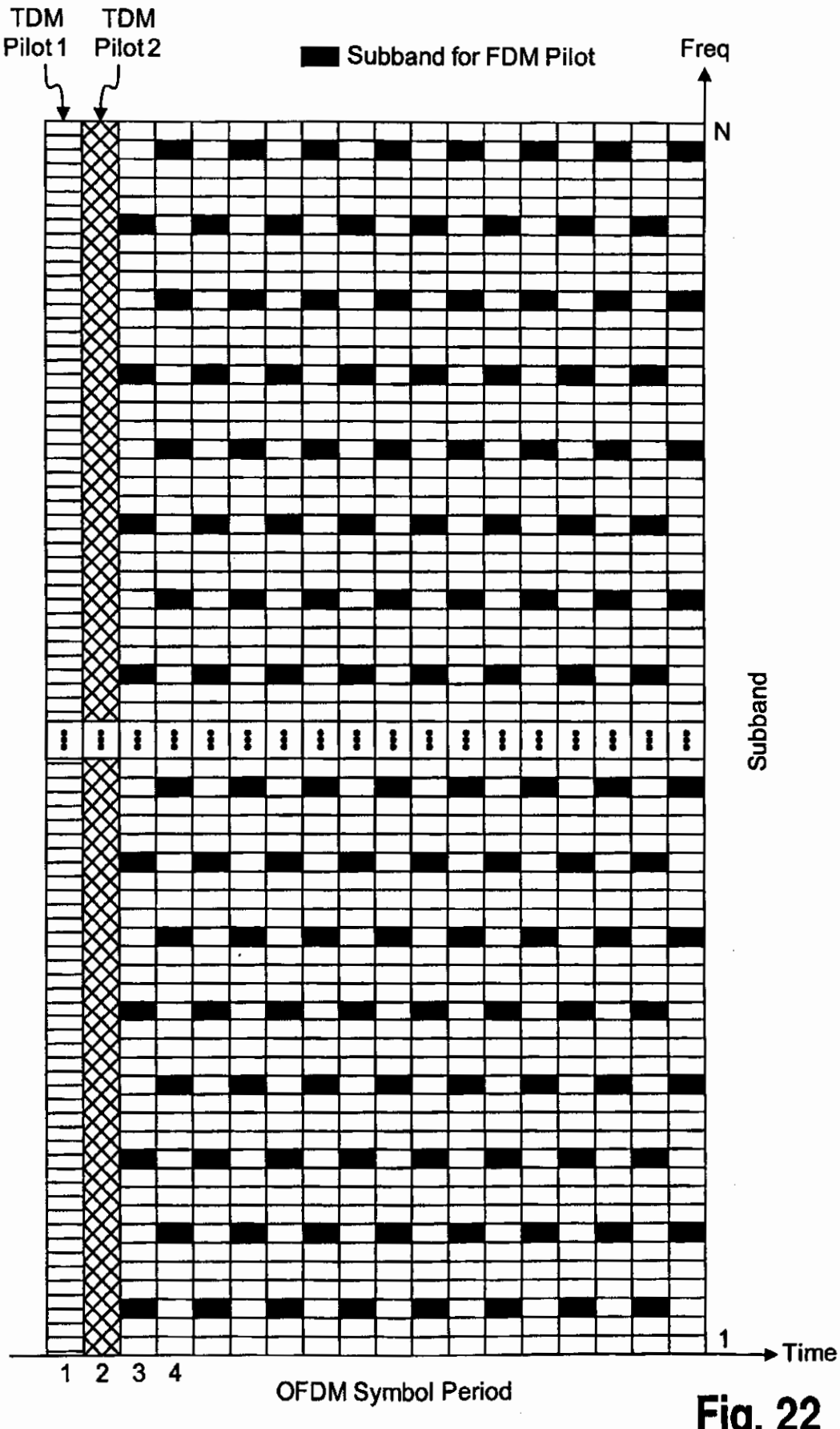

TDM Pilot 1
TDM Pilot 2
Subband for FDM Pilot
Freq
N
Subband
1
Time
1 2 3 4
OFDM Symbol Period

Fig. 22

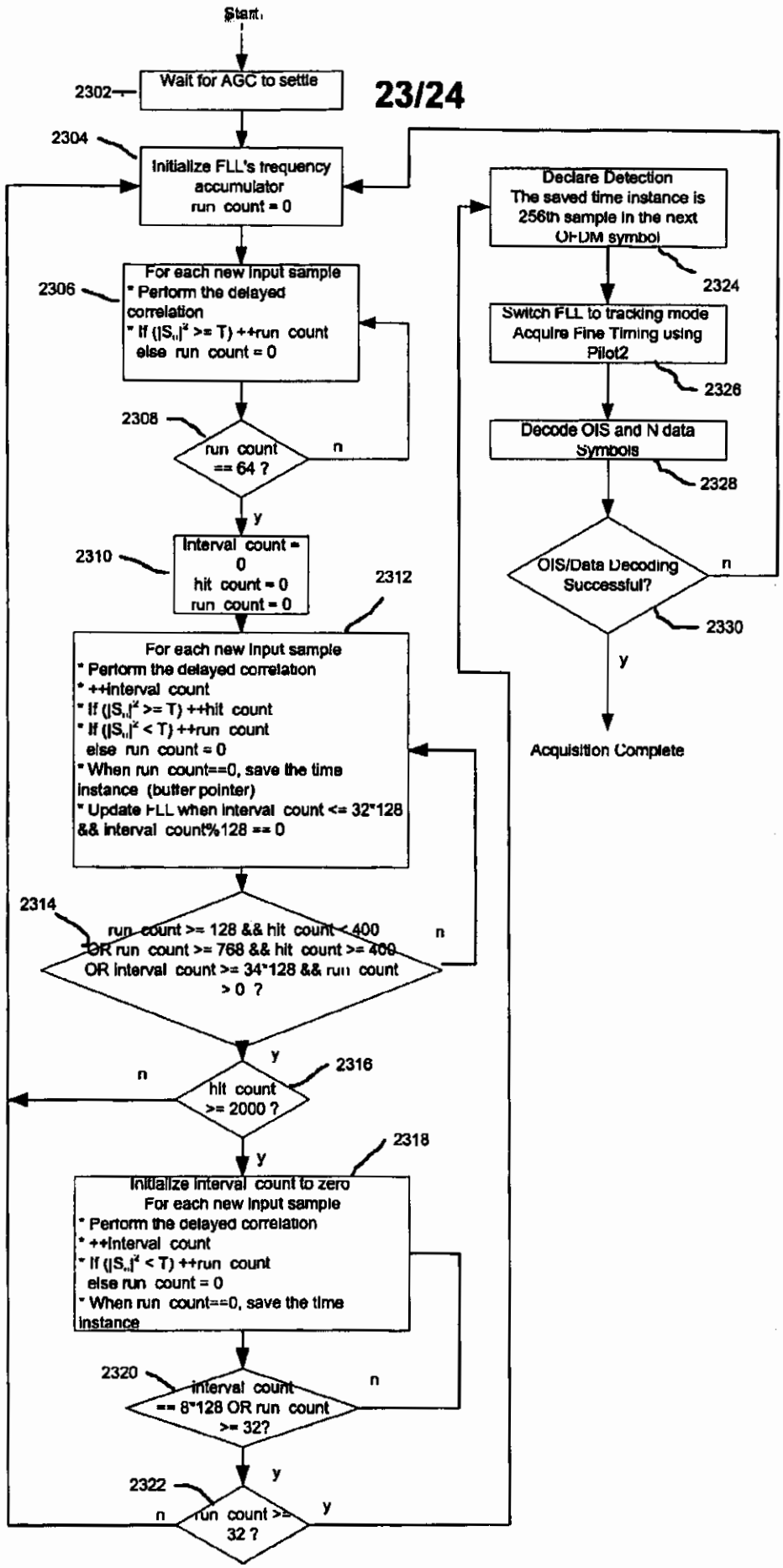
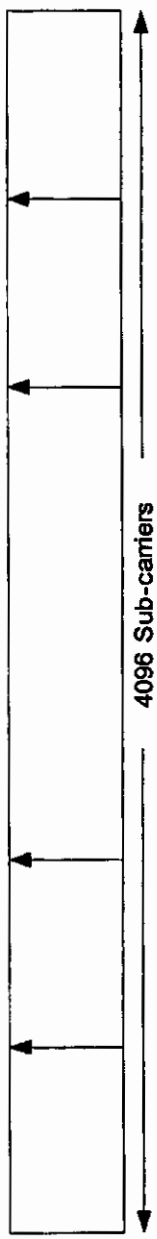
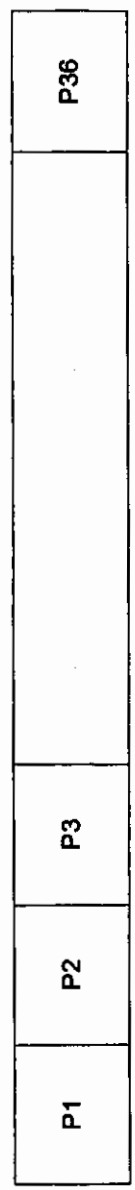

Start
2302
Wait for AGC to settle
2304
Initialize FLL's frequency accumulator
run count = 0
2306
For each new input sample
* Perform the delayed correlation
* If (|S_n|^2 >= T) ++run count
else run count = 0
2308
run count == 64 ?
n
y
2310
Interval count = 0
hit count = 0
run count = 0
2312
For each new input sample
* Perform the delayed correlation
* ++interval count
* If (|S_n|^2 >= T) ++hit count
* If (|S_n|^2 < T) ++run count
else run count = 0
* When run count==0, save the time instance (butter pointer)
* Update FLL when interval count <= 32*128 && interval count%128 == 0
2314
run count >= 128 && hit count < 400
OR run count >= 768 && hit count >= 400
OR interval count >= 34*128 && run count > 0 ?
n
y
2316
hit count >= 2000 ?
n
y
2318
Initialize interval count to zero
For each new input sample
* Perform the delayed correlation
* ++interval count
* If (|S_n|^2 < T) ++run count
else run count = 0
* When run count==0, save the time instance
2320
interval count == 8*128 OR run count >= 32?
n
y
2322
run count >= 32 ?
n
y
Declare Detection
The saved time instance is 256th sample in the next OFDM symbol
2324
Switch FLL to tracking mode
Acquire Fine Timing using Pilot2
2326
Decode OIS and N data Symbols
2328
OIS/Data Decoding Successful?
n
2330
y
Acquisition Complete

Figure 23



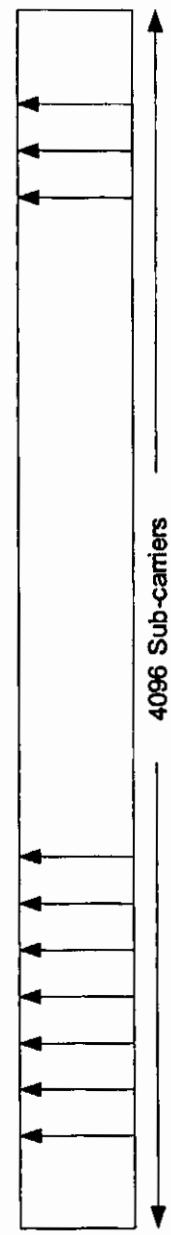
TDM Pilot1 in frequency domain, every 32 sub-carrier is non-zero

Figure 24



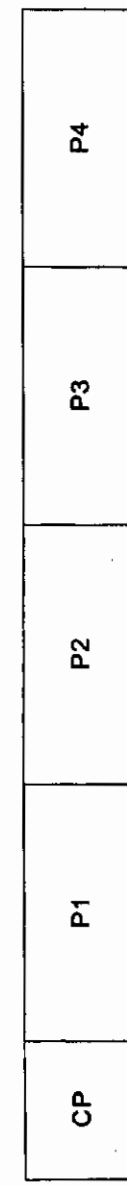
TDM Pilot1 in time domain, periodic waveform, periodicity 128 samples, 36 periods

Figure 25



TDM Pilot2 in frequency domain, every 4th sub-carrier is non-zero

Figure 26



TDM Pilot2 in time domain, periodic waveform, periodicity 1024 samples, 4 periods

Figure 27