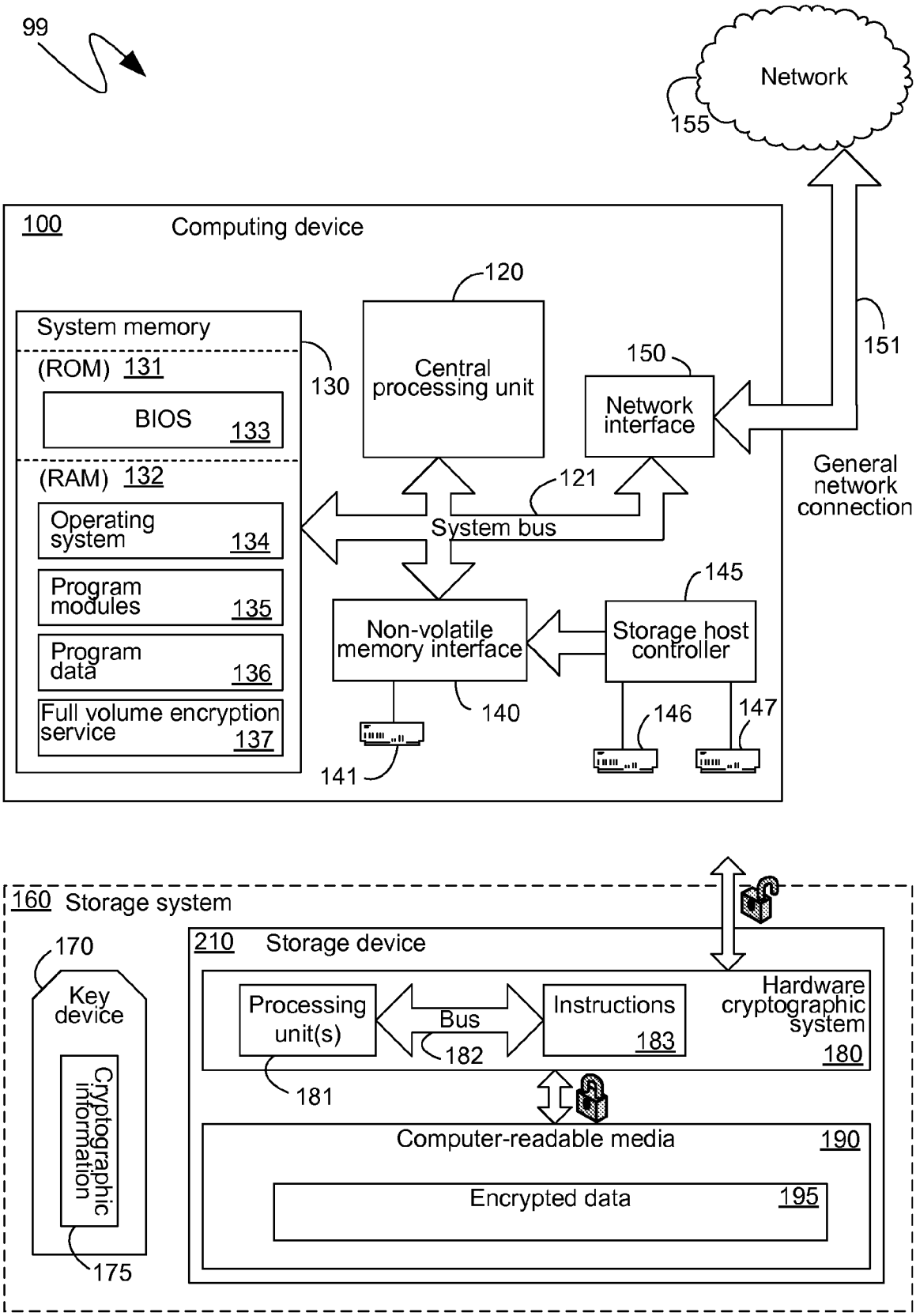

99
Network
155
100
Computing device
120
System memory
(ROM) 131
130
BIOS 133
(RAM) 132
Operating system 134
Program modules 135
Program data 136
Full volume encryption service 137
Central processing unit
150
Network interface
151
General network connection
121
System bus
145
Non-volatile memory interface
Storage host controller
140
146
147
141
160 Storage system
170
Key device
Cryptographic information
175
210 Storage device
Processing unit(s)
Bus
182
Instructions 183
Hardware cryptographic system 180
181
Computer-readable media 190
Encrypted data 195

Figure 1

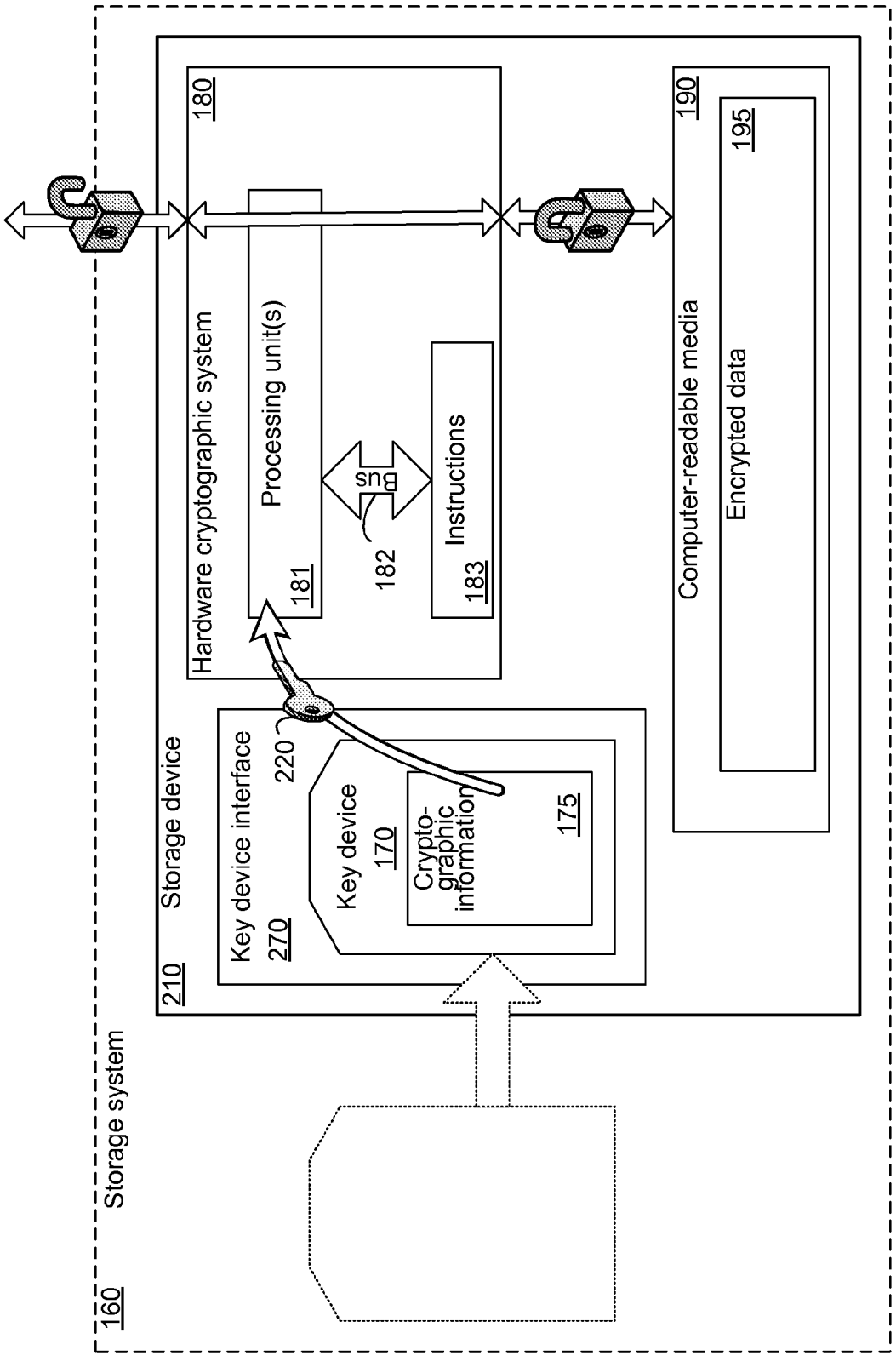

160
Storage system
210
Storage device
Key device interface
270
220
Key device
170
Crypto-graphic information
175
Hardware cryptographic system
180
Processing unit(s)
181
182
Instructions
183
Computer-readable media
190
Encrypted data
195

Figure 2

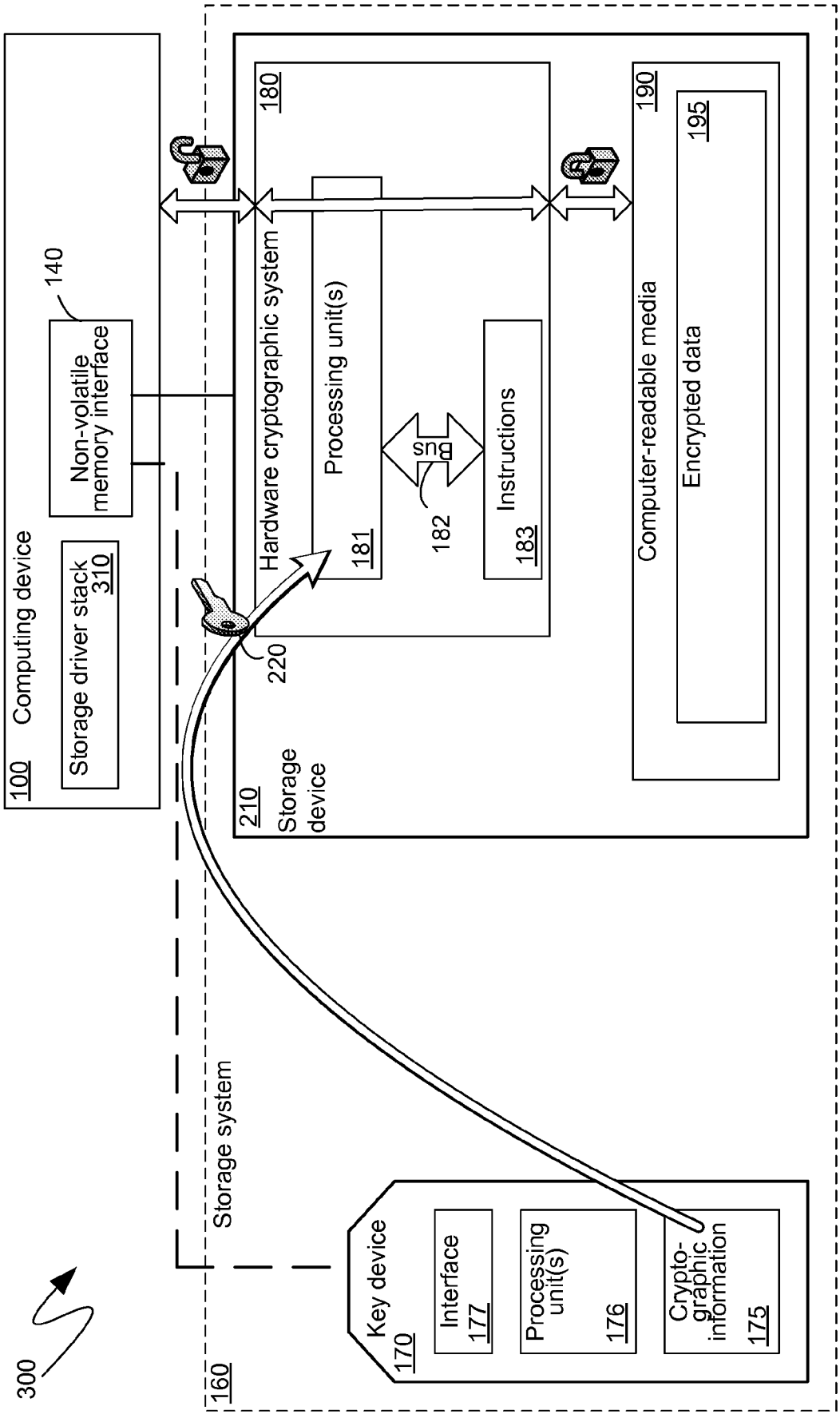

300
160
Storage system
Key device
170
Interface
177
Processing unit(s)
176
Crypto-graphic information
175
100
Computing device
Storage driver stack
310
Non-volatile memory interface
140
220
210
Storage device
Hardware cryptographic system
180
Processing unit(s)
181
182
BUS
Instructions
183
Computer-readable media
190
Encrypted data
195

Figure 3

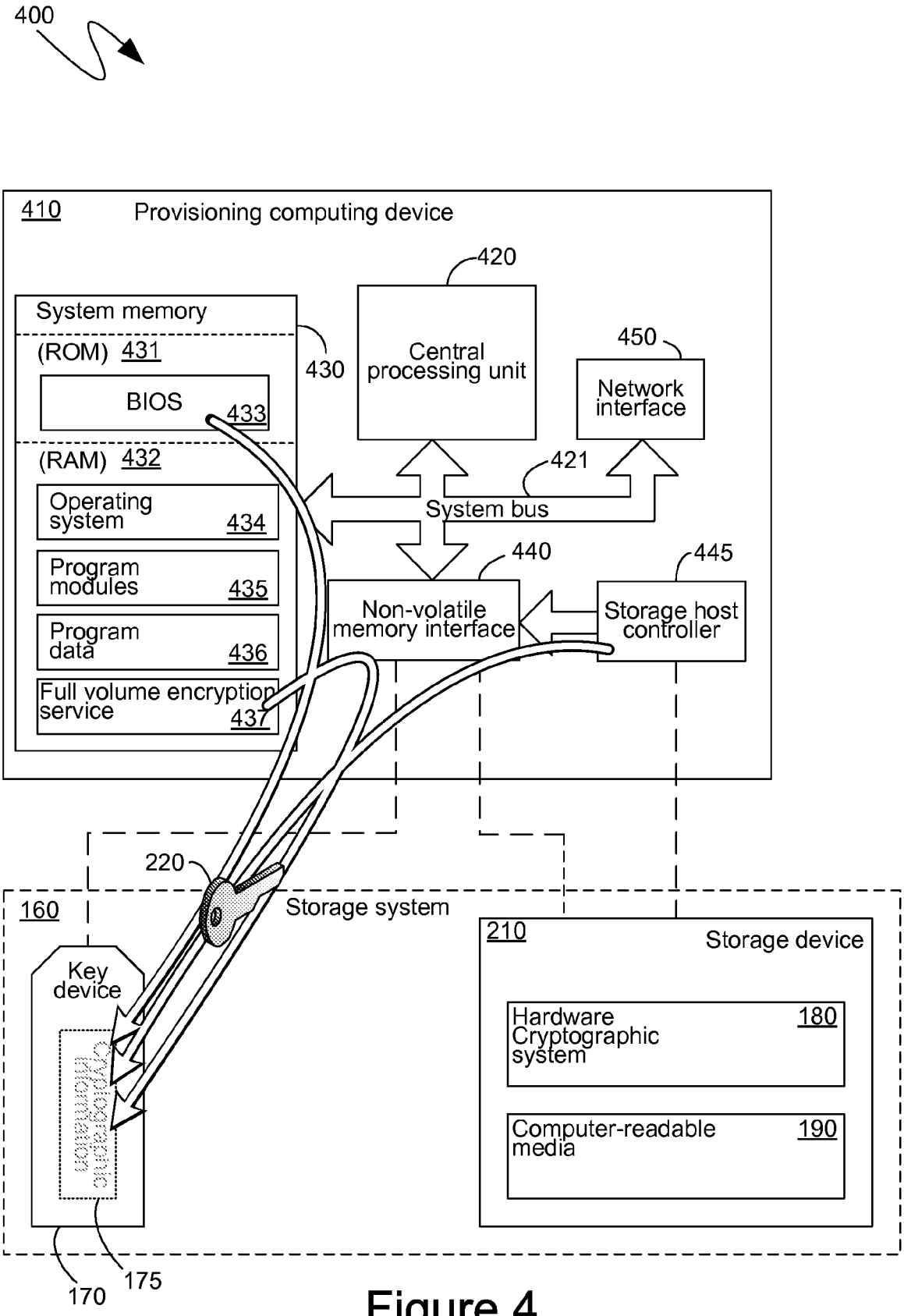

400
410
Provisioning computing device
420
System memory
(ROM) 431
BIOS
433
(RAM) 432
Operating system
434
Program modules
435
Program data
436
Full volume encryption service
437
430
Central processing unit
450
Network interface
421
System bus
440
Non-volatile memory interface
445
Storage host controller
220
160
Storage system
Key device
Cryptographic information
210
Storage device
Hardware Cryptographic system
180
Computer-readable media
190
170
175

Figure 4

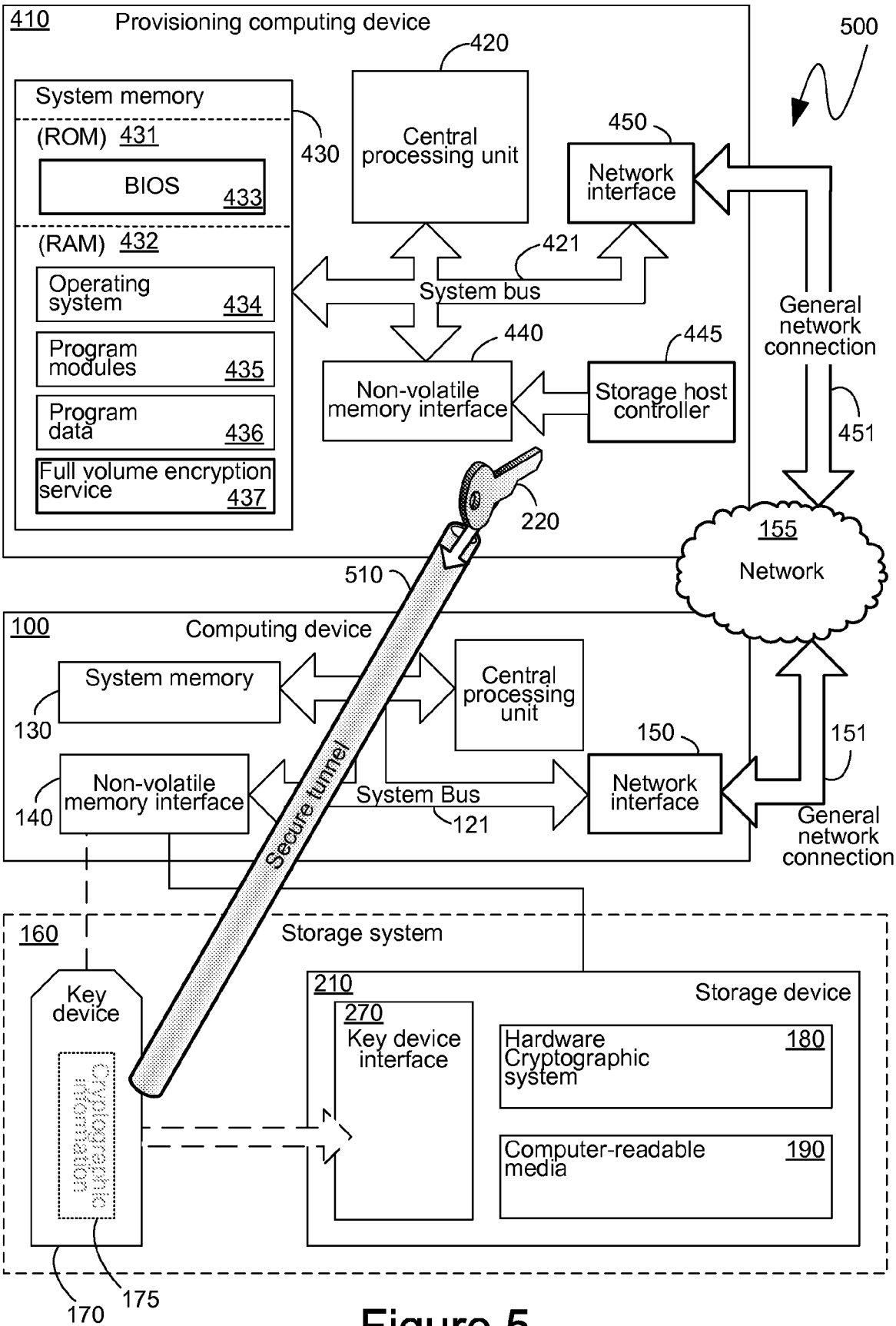

410
Provisioning computing device
500
420
System memory
(ROM) 431
BIOS 433
(RAM) 432
Operating system 434
Program modules 435
Program data 436
Full volume encryption service 437
430
Central processing unit
450
Network interface
421
System bus
440
445
Non-volatile memory interface
Storage host controller
General network connection
451
220
155
Network
510
100
Computing device
System memory
130
Central processing unit
150
151
Non-volatile memory interface
140
System Bus
121
Network interface
Secure tunnel
General network connection
160
Storage system
Key device
Cryptographic information
210
Storage device
270
Key device interface
Hardware Cryptographic system
180
Computer-readable media
190
170
175

Figure 5

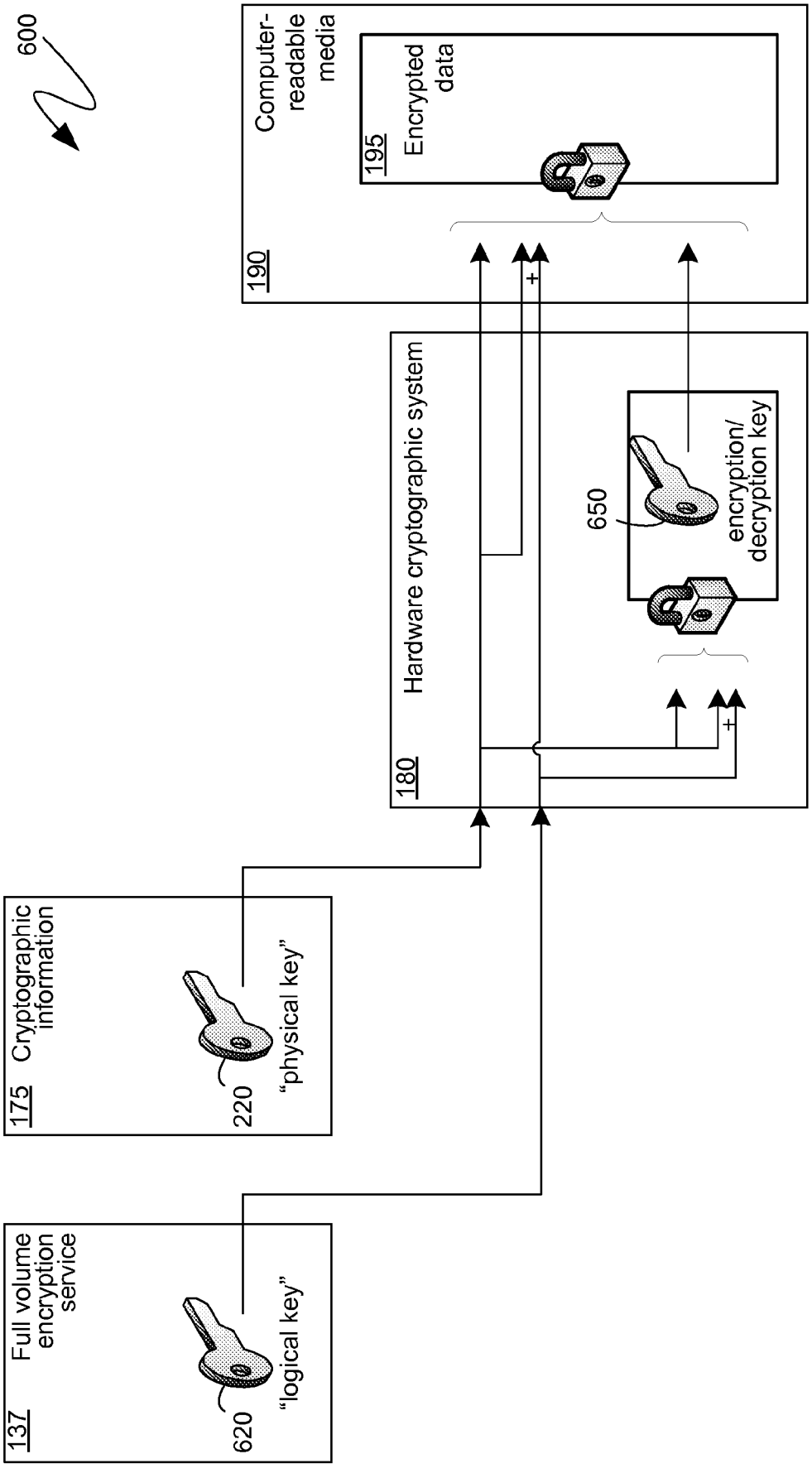

600
Computer-readable media
190
195
Encrypted data
Hardware cryptographic system
180
650
encryption/ decryption key
175
Cryptographic information
220
"physical key"
137
Full volume encryption service
620
"logical key"

Figure 6

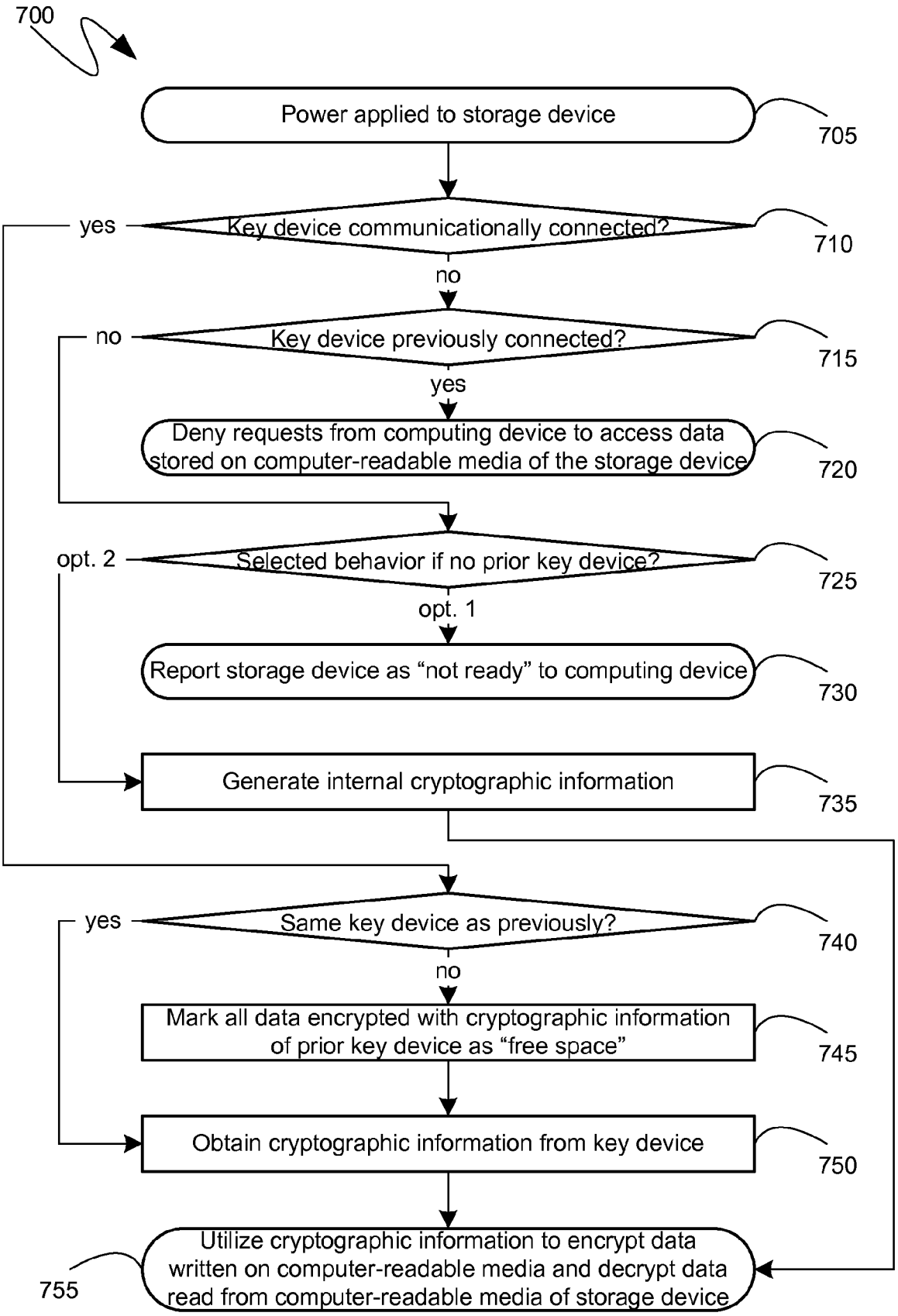

700
Power applied to storage device
705
yes
Key device communicationally connected?
710
no
no
Key device previously connected?
715
yes
Deny requests from computing device to access data stored on computer-readable media of the storage device
720
opt. 2
Selected behavior if no prior key device?
725
opt. 1
Report storage device as "not ready" to computing device
730
Generate internal cryptographic information
735
yes
Same key device as previously?
740
no
Mark all data encrypted with cryptographic information of prior key device as "free space"
745
Obtain cryptographic information from key device
750
Utilize cryptographic information to encrypt data written on computer-readable media and decrypt data read from computer-readable media of storage device
755

Figure 7

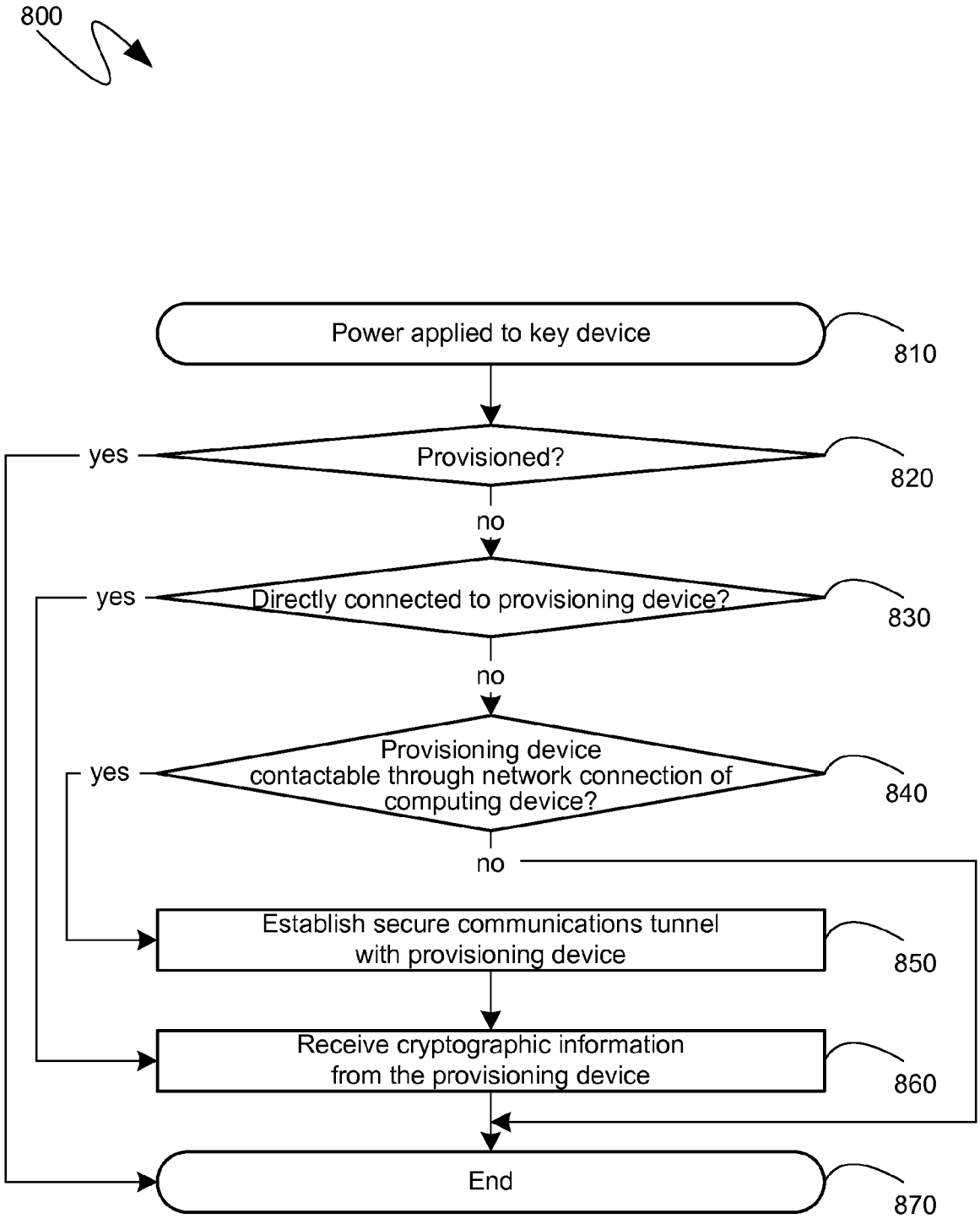

800
Power applied to key device
810
Provisioned?
yes
820
no
Directly connected to provisioning device?
yes
830
no
Provisioning device contactable through network connection of computing device?
yes
840
no
Establish secure communications tunnel with provisioning device
850
Receive cryptographic information from the provisioning device
860
End
870

Figure 8