CLAIMS

1. A navigation message authentication type positioning apparatus ~~(200, 300)~~, comprising:

a satellite receiver ~~(230, 330)~~ that receives a navigation message from an artificial satellite used in a satellite positioning system;

an authentication information acquisition portion ~~(S5)~~ that acquires, from an authentication center, authentication information in accordance with the navigation message received from the artificial satellite;

an authentication portion ~~(S9 to S11)~~ that authenticates that the navigation message received by the satellite receiver ~~(230, 330)~~ is authentic, by using the authentication information acquired by the authentication information acquisition portion ~~(S5)~~;

a positioning portion ~~(S42)~~ that determines a position of the navigation message authentication type positioning apparatus based on navigation messages received by the satellite receiver ~~(230, 330)~~ from a plurality of artificial satellites;

a storage portion ~~(220a, 330a)~~ that stores satellite information including at least orbit information about the artificial satellite of the navigation message received by the satellite receiver ~~(230, 330)~~ and an authentication result of the navigation message by the authentication portion ~~(S9 to S11)~~ even during power OFF period of the navigation message authentication type positioning apparatus;

an acquisition portion ~~(S24, S27)~~ that acquires, when the navigation message authentication type positioning apparatus ~~(200, 300)~~ is restarted, the artificial satellites by using the orbit information stored in the storage portion ~~(220a, 330a)~~;

a consistency determination portion ~~(S36, S36c)~~ that determines, when the navigation message having the authentication result of a succeeded authentication stored in the storage portion ~~(220a, 330a)~~ exists, whether the navigation message has a consistency with a navigation message received from the artificial satellite as a transmitter of the navigation message after restart of the navigation message authentication type positioning apparatus ~~(200, 300)~~ by using information included in the satellite

information of the navigation message stored in the storage portion ~~(220a, 330a)~~; and

a selection portion ~~(S38)~~ that selects, when the consistency determination portion ~~(S36, S36c)~~ determines that the consistency exists, the artificial satellite as the transmitter of the navigation message determined to have the consistency as the artificial satellite used for positioning in the positioning portion ~~(S42)~~,

wherein:

the positioning portion ~~(S42)~~ determines the position of the navigation message authentication type positioning apparatus by using the navigation message received from the artificial satellite that is selected by the selection portion ~~(S38)~~ among the artificial satellites acquired by the acquisition portion ~~(S24, S27)~~.

2. The navigation message authentication type positioning apparatus according to claim 1, wherein:

the storage portion ~~(220a, 330a)~~ also stores, as the satellite information, a transmission time when the artificial satellite has transmitted the navigation message of the navigation message received by the satellite receiver ~~(230, 330)~~; and

the consistency determination portion ~~(S36)~~ determines that the consistency exists

when a difference between

a time difference between the transmission time of the navigation message stored in the storage portion ~~(220a, 330a)~~ and a transmission time included in the navigation message received from the artificial satellite as the transmitter of the navigation message after the restart, and

a time difference between a reception time of the navigation message stored in the storage portion ~~(220a, 330a)~~ and a reception time of the navigation message received from the artificial satellite as the transmitter of the navigation message after the restart

is less than a threshold value.

3. The navigation message authentication type positioning apparatus according to claim 1, wherein:

the storage portion ~~(220a, 330a)~~ also stores, as the satellite information, a transmission time when the artificial satellite has transmitted the navigation message of the navigation message received by the satellite receiver ~~(230, 330)~~; and

the consistency determination portion ~~(S36c)~~ determines that the consistency exists

when a difference between

a pseudo distance determined from the transmission time of the navigation message stored in the storage portion ~~(220a, 330a)~~ and a reception time when the navigation message is received, and

a pseudo distance determined from the transmission time included in the navigation message received from the artificial satellite as the transmitter of the navigation message after the restart and a reception time when the navigation message is received after the restart

is less than a threshold value.

4. The navigation message authentication type positioning apparatus according to any one of claims 1 to 3, wherein:

the positioning portion ~~(S42)~~ can also use, for positioning, the navigation message received from the artificial satellite as the transmitter of the navigation message that has succeeded in authentication in the authentication portion ~~(S9 to S11)~~,

the navigation message authentication type positioning apparatus further comprising:

a determined position transmission processing portion ~~(S53)~~ that transmits the position determined in the positioning portion ~~(S42)~~ to an outside of the navigation message authentication type positioning apparatus,

wherein:

the determined position transmission processing portion ~~(S53)~~ adds, to the position determined in the positioning portion ~~(S42)~~, information showing

whether the artificial satellite used to determine the position is the artificial satellite as the transmitter of the navigation message that has succeeded in authentication in the authentication portion ~~(S9 to S11)~~, and

whether the artificial satellite used to determine the position is the artificial satellite selected by the selection portion ~~(S38)~~ as the artificial satellite used for the positioning in the positioning portion ~~(S42)~~

and transmits the position determined in the positioning portion ~~(S42)~~.

5. The navigation message authentication type positioning apparatus according to any one of claims 1 to 4, wherein:

the positioning portion ~~(S42)~~ can also use, for positioning, the navigation message received from the artificial satellite as the transmitter of the navigation message that has succeeded in authentication in the authentication portion ~~(S9 to S11)~~,

the navigation message authentication type positioning apparatus further comprising:

an authentication information transmission processing portion ~~(S63)~~ that transmits, to an outside of the navigation message authentication type positioning apparatus, identification information about the artificial satellite which allows the artificial satellite to be identified and authentication information showing whether the artificial satellite is the artificial satellite as the transmitter of the navigation message that has succeeded in authentication in the authentication portion ~~(S9 to S11)~~;

an authentication information reception processing portion ~~(S71)~~ that receives the identification information and the authentication information each transmitted from the authentication information transmission processing portion ~~(S63)~~ of a different navigation message authentication type positioning apparatus that is different from the navigation message authentication type positioning apparatus; and

a confirmation portion ~~(S80)~~ that determines that, when the artificial satellite selected as the artificial satellite used for positioning in the positioning portion ~~(S42)~~ by the selection portion ~~(S38)~~ of the navigation message authentication type positioning apparatus is specified as an identical artificial satellite as the artificial satellite as the transmitter of the navigation message that has succeeded in authentication in the authentication portion ~~(S9 to S11)~~ of the different navigation message authentication type positioning apparatus based on the identification information and the authentication information each received by the authentication information reception processing portion ~~(S71)~~, the artificial satellite selected by the selection portion ~~(S38)~~ of the navigation message authentication type positioning apparatus is proper as the artificial satellite used for positioning.