CLAIMS

1. A navigation message authentication type positioning apparatus, comprising:

a satellite receiver that receives one or more navigation messages from a one or more artificial satellites used in a satellite positioning system;

an authentication information acquisition portion that acquires, from an authentication center, authentication information in accordance with the one or more navigation messages received from the one or more artificial satellites;

an authentication portion that authenticates that the one or more navigation messages received by the satellite receiver are authentic, by using the authentication information acquired by the authentication information acquisition portion;

a positioning portion that determines a position of the navigation message authentication type positioning apparatus based on the one or more navigation messages received by the satellite receiver from the one or more of artificial satellites;

a storage portion that stores satellite information including at least orbit information about the one or more artificial satellites of the one or more navigation messages received by the satellite receiver, and an authentication result of the one or more navigation messages by the authentication portion even during power OFF period of the navigation message authentication type positioning apparatus;

an acquisition portion that acquires, when the navigation message authentication type positioning apparatus is restarted, the one or more artificial satellites by using the orbit information stored in the storage portion;

a consistency determination portion that determines, when the one or more navigation messages having the authentication result of a succeeded authentication stored in the storage portion exists, whether the one or more navigation messages have a consistency with one or more navigation messages received from the one or more artificial satellites as one or more transmitters of the one or more navigation messages after restart of the navigation message authentication type positioning apparatus by using

information included in the satellite information of the one or more navigation messages stored in the storage portion;

a selection portion that selects, when the consistency determination portion determines that the consistency exists, the one or more artificial satellites as the one or more transmitters of the one or more navigation messages determined to have the consistency with the one or more artificial satellites used for positioning in the positioning portion; and

a determination portion of a number of artificial satellites that determines whether a number of the one or more artificial satellites selected by the selection portion, of the one or more artificial satellites acquired by the acquisition portion, has reached a predetermined number of artificial satellites required for positioning of the navigation message authentication type positioning apparatus,

wherein:

when the determination portion of the number of artificial satellites determines that the number of the one or more artificial satellites selected by the selection portion, of the one or more artificial satellites acquired by the acquisition portion, is less than the predetermined number, the authentication portion authenticates the one or more navigation messages corresponding to a shortage number of artificial satellites in the positioning of the navigation message authentication type positioning apparatus; and

the positioning portion determines the position of the navigation message authentication type positioning apparatus by using the one or more navigation messages received from the one or more artificial satellites that are selected by the selection portion among the one or more artificial satellites acquired by the acquisition portion.

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

the storage portion also stores, as the satellite information, a transmission time when the one or more artificial satellites have transmitted the one or more navigation messages of the one or more navigation messages received by the satellite receiver; and

the consistency determination portion determines that the consistency exists

when a difference between

a time difference between the transmission time of the one or more navigation messages stored in the storage portion and a transmission time included in the one or more navigation messages received from the one or more artificial satellites as the one or more transmitters of the one or more navigation messages after the restart, and

a time difference between a reception time of the one or more navigation messages stored in the storage portion and a reception time of the one or more navigation messages received from the one or more artificial satellites as the one or more transmitters of the one or more navigation messages 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 also stores, as the satellite information, a transmission time when the one or more artificial satellites have transmitted the one or more navigation messages of the one or more navigation messages received by the satellite receiver; and

the consistency determination portion determines that the consistency exists

when a difference between

a pseudo distance determined from the transmission time of the one or more navigation messages stored in the storage portion and a reception time when the one or more navigation messages are received, and

a pseudo distance determined from the transmission time included in the one or more navigation messages received from the one or more artificial satellites as the one or more transmitters of the navigation messages after the restart and a reception time when the one or more navigation messages are 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 can also use, for positioning, the one or more navigation messages received from the one or more artificial satellites as the one or more transmitters of the one or more navigation messages that have succeeded in authentication in the authentication portion,

the navigation message authentication type positioning apparatus further comprising:

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

wherein:

the determined position transmission processing portion adds, to the position determined in the positioning portion, information showing

whether the one or more artificial satellites used to determine the position are the one or more artificial satellites that are the one or more transmitters of the one or more navigation messages that have succeeded in authentication in the authentication portion, and

whether the one or more artificial satellites used to determine the position is the one or more artificial satellites selected by the selection portion are the one or more artificial satellites used for the positioning in the positioning portion

and transmits the position determined in the positioning portion.

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

the positioning portion can also use, for positioning, the one or more navigation messages received from the one or more artificial satellites as the one or more transmitters of the one or more navigation messages that have succeeded in authentication in the authentication portion,

the navigation message authentication type positioning apparatus further comprising:

an authentication information transmission processing portion that transmits, to an outside of the navigation message authentication type positioning apparatus, identification information about the one or more artificial satellites which allow the one or more artificial satellites to be identified, and authentication information showing whether the one or more artificial satellites are the one or more artificial satellites that are the one or more transmitters of the one or more navigation messages that have succeeded in authentication in the authentication portion;

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

a confirmation portion that determines that, when one or more artificial satellites selected as the one or more artificial satellites used for positioning in the positioning portion by the selection portion of the navigation message authentication type positioning apparatus is specified as an identical artificial satellite as the one or more artificial satellites as the one or more transmitters of the one or more navigation messages that have succeeded in authentication in the authentication portion 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, the one or more artificial satellites selected by the selection portion of the navigation message authentication type positioning apparatus is proper as one or more artificial satellites used for positioning.