Perimeter Protection System and Method of Protecting a Perimeter

The present invention concerns a system for protecting the perimeter of vessels, such as merchant and naval ships, and marine installations, such as oil rigs and other marine platforms, against unauthorized potential boarders, such as pirates, stowaways and activists. The present invention also concerns a method of protecting a perimeter of a vessel or marine installation.

With increased criminality at sea, there has been a corresponding increase in the need for sea-going vessels and marine installations to be protected against such unauthorized potential boarders. The unauthorized potential boarders may approach a ship or platform, for example, in one or more smaller, high-speed boats equipped with a variety of ladders, climbing poles, grappling hooks and ropes. They may bring such a boat alongside the larger ship or platform, raise a ladder or climbing pole from the boat up the side of the larger ship or platform and attempt to board it by climbing the ladder or pole to gain access to a deck of the ship or platform. They may also attempt to throw a grappling hook attached to a rope on to the deck in order to catch hold of an item fixed to the deck, thereby allowing them to scale the rope. This has led to the development of a number of different types of known security bulwark for protecting the perimeter of vessels and marine installations by aiming to thwart such unauthorized potential boarders. These known security bulwarks are typically mounted over a perimeter railing running along the edge of a deck of the vessel or marine installation. Examples of these known types of security bulwark are described in JP 2001 191983 A, GB 2 496 757 A, CN 2014 72648 U, CN 2013 50963 Y, CN 2013 57935 Y and CN 2013 67101 Y.

In general, these known types of security bulwarks are arranged side-by-side adjacent to each other along the perimeter railing at the edge of a deck of a vessel or marine installation to create a perimeter protection system for the vessel or marine installation, the system comprising a plurality of such security bulwarks. However, the security bulwarks in such a perimeter protection system are generally identical to each other, and thus also have

substantially the same width as each other. On the other hand, the perimeter railing at the edge of a deck of a vessel or marine installation can generally be of any length. If the perimeter railing has a length ℓ and the security bulwarks each have a width w, it is unlikely that the length ℓ will be approximately equal to an integral multiple, n, of the width w, so that ℓ = nw and an whole number n of the security bulwarks can be arranged side-by-side adjacent to each other along the perimeter railing to cover the entire length of railing. This has several disadvantages as follows. Firstly, one or more sections of the perimeter railing which are together shorter than the width of one security bulwark may be left unprotected when the security bulwarks are arranged side-by-side adjacent to each other. This creates a point of weakness in the protection of the vessel or marine installation at each of the unprotected sections of railing, which can be exploited by unauthorized potential boarders to gain access to the vessel or marine installation on the principle of "a chain is only as strong as its weakest link". Alternatively, the entire length of railing can be covered by overlapping two or more adjacent security bulwarks or by cutting one or more security bulwarks down to size to fit the unprotected sections of railing. In the first case, overlapping two or more adjacent security bulwarks makes the security bulwarks difficult to mount to the railing and difficult to attach to each other, and therefore increases the amount of time needed to install the perimeter protection system on the vessel or marine installation. It also creates unevenness in the perimeter protection system which weakens its structural integrity and which can be exploited by unauthorized potential boarders to gain access to the vessel or marine installation. In the second case, cutting one or more security bulwarks down to size to fit the unprotected section of railing is time-consuming and laborious and therefore also increases the amount of time needed to install the perimeter protection system on the vessel or marine installation. It can also compromise the effectiveness of the security bulwarks which have been cut down in size, such that there still remains a point of weakness in the protection of the vessel or marine installation at the location of the security bulwarks which have been cut down in size, which can again be exploited by unauthorized potential boarders to gain access to the vessel or marine installation.

The present invention aims to address these and other problems with known systems for protecting the perimeter of vessels and marine installations. It also aims to provide an

improved perimeter protection system for a vessel or marine installation, and an improved method of protecting a perimeter of a vessel or marine installation.

Accordingly, in a first aspect, the present invention provides a perimeter protection system for a vessel or marine installation, the system comprising a first plurality of security bulwarks for mounting along a perimeter railing of the vessel or marine installation, each having a first width w, and a second plurality of spacers, each of which can be positioned abutting a side of one of the security bulwarks when the respective security bulwark is mounted along such a perimeter railing and each having a second width v which is a fraction of the first width w.

In such a perimeter protection system, the spacer has a width v which is a fraction of, that is to say, substantially less than, the width w of the security bulwark. For this reason, and also since the spacer can be positioned abutting a side of the security bulwark, it is no longer necessary to overlap two or more adjacent security bulwarks or to cut one or more security bulwarks down in size in order to cover an entire length of perimeter railing of a vessel or marine installation, the length ℓ of which is not an integral multiple, n, of the width w of the security bulwark, because the spacer can be used to increase the width w of the security bulwark by an amount v. Thus the security bulwark can be mounted to the railing quickly and easily, thereby reducing the amount of time required to install the perimeter protection system on the vessel or marine installation, and without any unevenness or damage to the security bulwark, thereby maintaining its effectiveness in thwarting unauthorized potential boarders.

Preferably, the first plurality, a, of such security bulwarks is arranged side-by-side adjacent to each other and the second plurality, b, of such spacers is positioned alongside the first plurality of such security bulwarks, the first plurality of such security bulwarks and the second plurality of such spacers abutting each other, whereby the combined width of the first plurality of such security bulwarks and the second plurality of such spacers is substantially equal to aw + bv. Thus by making an appropriate choice of the respective numbers, a and b, of bulwarks and spacers, the entire length, ℓ, of a perimeter railing can be protected by the first plurality of security bulwarks and the second plurality of spacers

abutting each other, without any need to overlap two or more adjacent security bulwarks or to cut one or more security bulwarks down to size, and without leaving any unprotected sections of railing.

If the perimeter protection system comprises a first plurality, a, of security bulwarks and a second plurality, b, of spacers as just described, it is preferable that respective ones of the second plurality of such spacers are each positioned between a respective adjacent pair of the first plurality of such security bulwarks, whereby the second plurality of such spacers alternates with respective ones of the first plurality of such security bulwarks. This helps to distribute the spacers evenly along the perimeter railing, which is advantageous, because it avoids a plurality of the spacers being positioned side-by-side adjacent to each other, where their combined width, bv, could otherwise be great enough to present an opening between an adjacent pair of security bulwarks for an unauthorized potential boarder to gain access to the vessel or marine installation.

It is preferable that in the perimeter protection system, the second width v is less than 10 percent of the first width w. This has the advantage of making the vessel perimeter protection system very adaptable to a variety of perimeter railings of different lengths, all of which may therefore be protected by different numbers of security bulwarks and spacers to an accuracy of less than 10 percent of the width of one security bulwark. For example, if one security bulwark has a width of one metre, then the entire length of a perimeter railing may be protected by security bulwarks and spacers to an accuracy of less than 100 mm. More preferably, the second width v is less than 5 percent of the first width w, and even more preferably still, the second width v is less than 2.5 percent of the first width w, which allow the perimeter protection system to be installed on a variety of perimeter railings of different lengths to within correspondingly greater levels of approximation between the length of the perimeter railing and the combined width of the security bulwarks and spacers.

It is also preferred that in the perimeter protection system, the second width v is less than about 100 millimetres. This has several advantages, including the following. Firstly, the entire length of a perimeter railing may then be protected by security bulwarks and spacers

to a correspondingly accuracy of less than 100 mm. Secondly, a spacer of such a small width does not present a significant gap between an adjacent pair of security bulwarks which might otherwise be exploited by an unauthorized potential boarder to gain access to the vessel or marine installation. Thirdly, a spacer of such a small width is not readily visible to an unauthorized potential boarder in a boat alongside the vessel or marine installation, especially if the spacer and the security bulwark are the same colour as each other. More preferably, the second width v is less than about 50 millimetres, and even more preferably still the second width v is about 25 millimetres or less.

Preferably, an adjacent pair of the security bulwarks is connected to each other via a respective connection device of one or more of the spacers positioned between the adjacent pair of such security bulwarks. This allows for quick and easy connection of the adjacent pair of the security bulwarks to each other via the one or more of the spacers positioned between them, in order to form a strong and structurally sound security barrier comprising the adjacent pair of security bulwarks and the one or more spacers.

The connection device may be part of a plug and socket system, for example with a plug formed on a respective first side of each security bulwark and of each spacer, and a socket formed on a respective opposing second side of each security bulwark and of each spacer. Preferably, however, the connection device comprises a respective through-hole from a respective first side to a respective opposing second side of each of the one or more such spacers. If so, the adjacent pair of security bulwarks may be quickly and easily connected to each other and the spacer secured to them both by inserting a connector, such as a bolt, through the through-hole.

Preferably, at least one of the security bulwark and the spacer are slightly flexible, and/or the connection device of the spacer allows for variation or “play” in the separation of the adjacent pair of security bulwarks, so that the combined width of the security bulwarks and spacers can be adjusted to more closely approximate to the length of the perimeter railing.

The spacer may have a side profile which mirrors that of the security bulwark. Preferably, the spacer has a front or seaward face which is substantially smooth and featureless, so that

it does not present a handhold which could otherwise be used by an unauthorized potential boarder trying to scale the perimeter protection system to gain access to a deck of the vessel or marine installation.

Preferably, a first height, k, of the spacer is less than or equal to a second height, h, of the security bulwark. This ensures that if the spacer is positioned alongside the security bulwark, a top of the spacer does not protrude above an uppermost edge of the security bulwark, so that it cannot be used by an unauthorized potential boarder either as a target to throw a rope around or as a handhold if the boarder is trying to climb over the perimeter protection system to gain access to the deck of the vessel or marine installation.

Preferably, a first depth, e, of the spacer is less than or equal to a second depth, d, of the security bulwark. This ensures that if the spacer is positioned alongside the security bulwark, a front or seaward face of the spacer does not project out in a seaward direction from a front or seaward face of the security bulwark, so that it cannot be used by an unauthorized potential boarder as a handhold if the boarder is trying to scale the perimeter protection system to gain access to the deck of the vessel or marine installation.

The perimeter protection system may further comprise a second type of security bulwark for mounting along a perimeter railing of the vessel or marine installation and having a third width x different from the first width w. For example, the second type of security bulwark may have a width x substantially equal to one-half of the first width w. Such a second type of security bulwark may be used to substitute for a plurality of spacers or at specific locations along the perimeter railing, as required. Alternatively or additionally, the perimeter protection system may further comprise a second type of spacer positionable abutting a side of the respective security bulwarks and having a fourth width y which is different from the second width v. For example, the second type of spacer may have a width y substantially equal to one-half of the second width v. Such a second type of spacer may be used to more closely approximate the combined width of the security bulwarks and spacers to the length of the perimeter railing.

In a second aspect, the present invention also provides a method of protecting a perimeter of a vessel or marine installation, the method comprising mounting a first plurality, a, of security bulwarks having a first width w side-by-side and adjacent to each other along a perimeter railing of the vessel or marine installation, positioning a second plurality, b, of spacers each having a second width v which is a fraction of the first width w alongside the first plurality of security bulwarks, abutting the first plurality of security bulwarks and the second plurality of spacers with each other, whereby the combined width aw + bv of the first plurality of security bulwarks and the second plurality of spacers is made substantially equal to a length ℓ of the perimeter railing.

In this manner, the entire length ℓ of the perimeter railing can be protected by the first plurality of security bulwarks and the second plurality of spacers abutting each other without any need to overlap two or more adjacent security bulwarks or to cut one or more security bulwarks down to size and without leaving any unprotected sections of railing. This also allows the perimeter of the vessel or marine installation to be protected quickly and easily and without any unevenness in or damage to the security bulwarks, thereby maintaining their effectiveness in thwarting unauthorized potential boarders.

Preferably, the method further comprises positioning respective ones of the second plurality of spacers each between a respective adjacent pair of the first plurality of security bulwarks, thereby alternating the second plurality of spacers with respective ones of the first plurality of security bulwarks. This helps to distribute the spacers evenly along the perimeter railing, which is advantageous, because it avoids a plurality of the spacers being positioned side-by-side adjacent to each other, where their combined width, bv, could otherwise be great enough to present an opening between an adjacent pair of security bulwarks for an unauthorized potential boarder to gain access to the vessel or marine installation.

Preferably, the method further comprises connecting an adjacent pair of the security bulwarks to each other via a respective connection device of one or more of the plurality of spacers positioned between the adjacent pair of security bulwarks. This helps to form a

strong and structurally sound security barrier comprising the adjacent pair of security bulwarks and the one or more spacers.

If so, the method preferably comprises connecting the adjacent pair of security bulwarks to each other via a respective through-hole from a respective first side to a respective opposing second side of each of the one or more of the plurality of spacers. This allows the one or more spacers to be secured to the adjacent pair of security bulwarks quickly and easily by inserting a connector, such as a bolt, through the through-hole.

Further features and advantages of the present invention will become apparent from the following detailed description, which is given by way of example and in association with the accompanying drawings, in which:

Fig. 1 is a perspective view from an outside or seaward side of a part of a perimeter railing of a vessel or marine installation;

Fig. 2 is a perspective view from an inside or deck side of the part of the perimeter railing shown in Fig. 1;

Fig. 3 is a perspective view from the outside or seaward side of a plurality of security bulwarks mounted on the part of the perimeter railing shown in Figs. 1 and 2;

Fig. 4 is a perspective view from the inside or deck side of the same plurality of security bulwarks as shown in Fig. 3 mounted on the part of the perimeter railing shown in Figs. 1 and 2;

Fig. 5 is a perspective view from the outside or seaward side of a representative part of a first embodiment of a perimeter protection system for mounting along a perimeter railing of a vessel or marine installation;

Fig. 6 is a perspective view from the inside or deck side of the part of the perimeter protection system shown in Fig. 5;

Fig. 7 is a first perspective view of a security bulwark in the perimeter protection system shown in Figs. 5 and 6;

Fig. 8 is a second perspective view of the security bulwark shown in Fig. 7;

Fig. 9 is a first perspective view of a spacer in the perimeter protection system shown in Figs. 5 and 6;

Fig. 10 is a second perspective view of the spacer shown in Fig. 9;

Fig. 11 is a perspective view from the outside or seaward side of a representative part of a second embodiment of a perimeter protection system for mounting along a perimeter railing of a vessel or marine installation;

Fig. 12 is a perspective view from the inside or deck side of the part of the perimeter protection system shown in Fig. 11;

Fig. 13 is a first perspective view of a security bulwark in the perimeter protection system shown in Figs. 11 and 12;

Fig. 14 is a second perspective view of the security bulwark shown in Fig. 13;

Fig. 15 is a first perspective view of a spacer in the perimeter protection system shown in Figs. 11 and 12;

Fig. 16 is a second perspective view of the spacer shown in Fig. 15; and

Fig. 17 is a third perspective view of the spacer shown in Figs. 15 and 16.

Figs. 1 and 2 respectively show views from an outside or seaward side and from an inside or deck side of a representative part of a perimeter railing 20 of a vessel or marine installation.

Part of a side of the vessel or marine installation can be seen labelled with reference numeral 52. The perimeter railing 20 comprises a plurality of courses of rails, which include a topmost handrail 201, a middle course of rails 202 and a lowest course of rails 203. At regular intervals along the perimeter railing 20 are a plurality of vertical stanchions 204. Regulations require that the vertical stanchions 204 are spaced no more than 1.5 metres apart. The perimeter railing 20 is mounted on a deck 51 of the vessel or marine installation. The overall height, g, of the railing 20 from the deck 51 to the topmost handrail 201 is required by regulations to be at least 1 metre. The separation, f, of the lowest course of rails 203 from the deck 51 is also required by regulations to be no more than 230 mm. The middle course of rails 202 is positioned approximately equidistant between the topmost handrail 201 and the lowest course of rails 203. Thus a gap between the topmost handrail 201 and the middle course of rails 202 or between the middle course of rails 202 and the lowest course of rails 203 is given by $(g - f)/2$, from which must also be subtracted the thickness of the courses of rails themselves. Each gap is therefore usually not more than 500 mm in height, and, in practice, is considerably less than this. Outside the railing 20 at the edge of the deck 51 is a vertical lip called a fishplate 53, the height of which depends upon the type of vessel or marine installation on which the railing 20 is mounted, but which, in general, is between about 90 and about 400 mm in height.

Figs. 3 and 4 respectively show views from the outside or seaward side and from the inside or deck side of the same perimeter railing 20 as is shown in Figs. 1 and 2, on which a plurality of security bulwarks 1a, 1b, 1c have been mounted side-by-side adjacent to each other. The security bulwarks 1a, 1b, 1c have substantially the same width as each other. On the other hand, the perimeter railing 20 has a length which is not an integral multiple of the width of the security bulwarks 1a, 1b, 1c. Thus if additional security bulwarks having substantially the same width as the security bulwarks 1a, 1b, 1c are arranged alongside them, the totality of the security bulwarks 1a, 1b, 1c with the additional security bulwarks fails to cover the entire length of the railing 20, even though the totality of bulwarks are mounted side-by-side adjacent to each other. A section of the perimeter railing 20 which is shorter than the width of one of the security bulwarks 1a, 1b, 1c is therefore left unprotected.

Figs. 5 and 6 respectively show views from the outside or seaward side and from the inside or deck side of a representative part of a first embodiment of a perimeter protection system 100 suitable for mounting along a perimeter railing of a vessel or marine installation. The perimeter protection system 100 comprises a security bulwark 1a having a first width, w, for mounting along a perimeter railing, such as the perimeter railing 20 shown in Figs. 1 and 2. The perimeter protection system 100 also comprises a spacer 40a which can be positioned abutting a side of the security bulwark 1a. The spacer 40a has a second width, v, which is a fraction of the first width, w, that is to say, substantially less than the width, w, of the security bulwark 1a.

The perimeter protection system 100 comprises a first plurality, a, of such security bulwarks 1a, 1b, 1c arranged side-by-side adjacent to each other and a second plurality, b, of such spacers 40a, 40b positioned alongside the first plurality of such security bulwarks. The first plurality, a, of security bulwarks 1a, 1b, 1c and the second plurality, b, of spacers 40a, 40b abut each other. Thus the combined width, aw + bv, of the first plurality, a, of security bulwarks 1a, 1b, 1c and the second plurality, b, of spacers 40a, 40b can be made substantially equal to a length, ℓ, of the perimeter railing by an appropriate choice of the respective numbers, a and b, of the security bulwarks and spacers. For example, suppose that the length, ℓ, of the perimeter railing is 34.56 metres, the width, w, of each security bulwark is 1 metre, and the width, v, of each spacer is 25 mm. In this example, therefore, the second width, v, of the spacers, is only 2.5 percent of the first width, w, of the security bulwarks. Then by choosing the number, a, of security bulwarks to be 34 and the number, b, of spacers to be 22, the combined width, aw + bv, of the security bulwarks and spacers is equal to (34 x 1) + (22 x 0.025) = 34.55 metres, which is substantially equal to the length, ℓ = 34.56 metres, of the perimeter railing. The small difference of 34.56 – 34.55 = 0.01 metres (or just 10 mm) between the combined width of the security bulwarks and spacers on the one hand and the length of the perimeter railing on the other can be accommodated by some slight flexibility of the security bulwarks, or by very small variations, each of less than 1 mm, in the separation of the adjacent pairs of security bulwarks.

In the perimeter protection system 100, respective ones 40a, 40b of the plurality of spacers are each positioned between a respective adjacent pair 1a, 1b; 1b, 1c of the plurality of

security bulwarks, so that the spacers 40a, 40b and the security bulwarks 1a, 1b, 1c alternate with each other. Thus the spacers are distributed evenly along the perimeter railing, which avoids a plurality of the spacers being positioned side-by-side adjacent to each other, where their combined width, bv, could otherwise be great enough to present an opening between an adjacent pair of security bulwarks sufficiently wide for an unauthorized potential boarder to gain access to the vessel or marine installation. For example, if 22 spacers, each having a width, v = 25 mm, were all positioned side-by-side adjacent to each other, their combined width of 22 x 0.025 = 0.55 metres would present an opening between an adjacent pair of security bulwarks sufficiently wide for an unauthorized potential boarder to gain access to the vessel or marine installation.

Figs. 7 and 8 are two different views of an embodiment of a security bulwark 1 in the perimeter protection system 100 shown in Figs. 5 and 6. The security bulwark 1 has a height, h, of between 500 mm and 1000 mm. Thus all of the gaps between the courses of rails in a railing to which the bulwark 1 is mounted, from the lowest course of rails to the topmost handrail, are at least partially covered by the bulwark 1, whilst still leaving an opening between a lowermost edge 62 of the bulwark 1 and a deck, to allow seawater from waves which break on to the deck to wash back over the edge of the vessel or marine installation into the sea. The security bulwark 1 has a width, w, of between 350 mm and 1500 mm, which is sufficiently large to cover a length of perimeter railing quickly and easily with a plurality of such bulwarks, whilst also being sufficiently small for one person to be able to handle the bulwark 1 with ease when mounting it to the railing.

The security bulwark 1 has two sides 16, which if the bulwark is mounted to a perimeter railing, are oriented substantially perpendicular to the railing on which the bulwark is mounted. The two sides 16 each comprise a plurality of connection sites 17 for connecting the bulwark 1 to an adjacent security bulwark. The connection sites 17 each comprise a through-hole formed in the respective side 16 of the bulwark 1 and which is able to receive a connector 18, such as a bolt.

Figs. 9 and 10 are two different views of an embodiment of a spacer 40 in the perimeter protection system 100 shown in Figs. 5 and 6. The spacer 40 has a height, k, which is less

than or equal to the height, h, of the security bulwark 1. Thus if the spacer 40 is positioned alongside the security bulwark 1, a top end 44 of the spacer 40 does not protrude above an uppermost edge 12 of the security bulwark 1. The spacer 40 also has a depth, e, which is less than or equal to a depth of the security bulwark 1, denoted in Fig. 8 by the letter d. Thus if the spacer 40 is positioned alongside the security bulwark 1, a front or seaward face 46 of the spacer 40 does not project out in a seaward direction from a front or seaward face 2 of the security bulwark 1. The front or seaward face 46 of the spacer 40 is substantially smooth and featureless, so that it does not present a handhold which could otherwise be used by an unauthorized potential boarder trying to scale the perimeter protection system 100 in order to gain access to the deck of the vessel or marine installation on which the perimeter protection system 100 is installed.

The spacer 40 comprises a first side 41 and an opposing second side 43, both of which can be positioned abutting a respective one of the sides 16 of the security bulwark 1. As can be seen, the profile of the sides 41, 43 mirrors that of the sides 16 of the security bulwark 1. The spacer 40 also comprises a plurality of connection devices 42, each of which comprises a respective through-hole from the first side 41 to the opposing second side 43 of the spacer 40. The locations of the connection devices 42 on the spacer 40 correspond to the locations of the connection sites 17 on the sides 16 of the security bulwark 1. Thus if a pair of such security bulwarks 1 are arranged side-by-side adjacent to each other with one or more of the spacers 40 positioned between them, the connection devices 42 on the spacers 40 can be aligned with the connection sites 17 on the sides 16 of the security bulwarks 1. The adjacent pair of security bulwarks 1 can then be connected to each other via the respective connection devices 42 of the one or more spacers 40. For example, a connector 18, such as a bolt, can be inserted into a through-hole in the side 16 of a first one of the pair of security bulwarks 1, through the through-hole of the respective connection devices 42 of the one or more spacers 40 and out of a through-hole in the side 16 of the other one of the pair of security bulwarks 1, in a direction parallel with a perimeter railing to which the perimeter protection system 100 is mounted. The bolt can then be fitted with a nut, for example, and both can be tightened together until the adjacent pair of security bulwarks 1 and the one or more spacers 40 positioned between them abut each other. This allows for quick and easy connection of the adjacent pair of the security bulwarks 1 to each other via the one or more

of the spacers 40 positioned between them, to form a strong and structurally sound security barrier comprising the adjacent pair of security bulwarks 1 and the one or more spacers 40.

Figs. 11 and 12 respectively show views from an outside or seaward side and from an inside or deck side of a representative part of a second embodiment of a perimeter protection system 200 suitable for mounting along a perimeter railing of a vessel or marine installation. The perimeter protection system 200 comprises a security bulwark 119a having a first width, w, for mounting along a perimeter railing, such as the perimeter railing 20 shown in Figs. 1 and 2. The perimeter protection system 200 also comprises a spacer 140a which can be positioned abutting a side of the security bulwark 119a. The spacer 140a has a second width, v, which is a fraction of the first width, w, that is to say, substantially less than the width, w, of the security bulwark 119a.

The perimeter protection system 200 comprises a first plurality, a, of such security bulwarks 119a, 119b, 119c arranged side-by-side adjacent to each other and a second plurality, b, of such spacers 140a, 140b positioned between and abutting each of an adjacent pair of the plurality of security bulwarks 119a, 119b, 119c. Thus the combined width, aw + bv, of the first plurality, a, of security bulwarks 119a, 119b, 119c and the second plurality, b, of spacers 140a, 140b can therefore be made substantially equal to a length, ℓ, of the perimeter railing by an appropriate choice of the respective numbers, a and b, of the security bulwarks and spacers, in a similar manner to that described above in relation to Figs. 5 and 6.

Figs. 13 and 14 are two different views of an embodiment of a security bulwark 119 in the perimeter protection system 200 shown in Figs. 11 and 12. The security bulwark 119 has a height, h, of between 500 mm and 1000 mm. Thus all of the gaps between the courses of rails in a railing to which the bulwark 119 is mounted, from the lowest course of rails to the topmost handrail, are at least partially covered by the bulwark 119, whilst still leaving an opening between a lowermost edge 62 of the bulwark 119 and a deck, to allow seawater from waves which break on to the deck to wash back over the edge of the vessel or marine installation into the sea. The security bulwark 119 has a width, w, of between 350 mm and 750 mm, which is sufficiently large to cover a length of perimeter railing quickly and easily

with a plurality of such bulwarks, whilst also being sufficiently small for one person to be able to handle the bulwark 119 with ease when mounting it to the railing.

The security bulwark 119 has two sides 116, which if the bulwark is mounted to a perimeter railing, are oriented substantially perpendicular to the railing on which the bulwark is mounted. The two sides 116 each comprise a plurality of connection sites 117 for connecting the bulwark 119 to an adjacent security bulwark. The connection sites 117 each comprise a through-hole formed in the respective side 116 of the bulwark 119 and which is able to receive a connector 18, such as a bolt.

Figs. 15 to 17 are three different views of a spacer 140 in the perimeter protection system 200 shown in Figs. 11 and 12. The spacer 140 has a height, k, which is less than or equal to the height, h, of the security bulwark 119. Thus if the spacer 140 is positioned alongside the security bulwark 119, a top end 144 of the spacer 140 does not protrude above an uppermost edge 112 of the security bulwark 119.

The spacer 140 comprises a first side 141 and an opposing second side 143, each of which can be positioned abutting a respective one of the sides 116 of the security bulwarks 119. As can be seen from Figs. 15 to 17, the profile of the first and second sides 141, 143 of the spacer 140 mirrors that of the sides 116 of the security bulwarks 119. A depth of the two sides 141, 143, denoted in Fig. 17 by the letter e, is less than or equal to a depth of the security bulwark 119, which is equal to the depth of each of the two sides 116 of the security bulwark 119 and is denoted in Fig. 14 by the letter d.

The spacer 140 also comprises a plurality of through-holes 142 from the first side 141 to the opposing second side 143 of the spacer 140. The locations of the through-holes 142 on the spacer 140 correspond to the locations of the connection sites 117 on the sides 116 of the security bulwarks 119. Thus if a pair of such security bulwarks 119 are arranged side-by-side adjacent to each other with one of the spacers 140 positioned between them, the through-holes 142 on the spacers 140 can be aligned with the connection sites 117 on the sides 116 of the security bulwarks 119. The adjacent pair of security bulwarks 119 can then be connected to each other via the respective through-holes 142 of the spacer 140 positioned

between them. For example, a connector, such as a bolt, can be inserted into a through-hole in the side 116 of a first one of the pair of security bulwarks 119, through the respective through-hole 142 of the spacer 140 and out of a through-hole in the side 116 of the other one of the pair of security bulwarks 119, in a direction parallel with a perimeter railing to which the perimeter protection system 200 is mounted. The bolt can then be fitted with a nut, for example, and both can be tightened together until the adjacent pair of security bulwarks 119 and the spacer 140 positioned between them abut each other. This allows for quick and easy connection of the adjacent pair of the security bulwarks 119 to each other via the spacer 140 positioned between them, to form a strong and structurally sound security barrier comprising the adjacent pair of security bulwarks 119 and the spacer 140.

As may also be seen in Figs. 15 to 17, the spacer 140 differs from the spacer 40 shown in Figs. 9 and 10 in that the spacer 140 further comprises a protruding nose 146 extending from the two sides 141, 143 of the spacer 140. Thus when the spacer 140 is positioned between an adjacent pair of security bulwarks 119 in a perimeter protection system, the nose 146 projects outwardly in a seaward direction between the adjacent pair of security bulwarks 119, as may best be seen in Fig. 11. This provides an additional obstruction to thwart unauthorized potential boarders from trying to squeeze between the adjacent pair of security bulwarks 119.

Claims

1. A perimeter protection system (100, 200) comprising:

a first plurality of security bulwarks (1, 119) for mounting along a perimeter railing (20) of a vessel or marine installation and having a first width (w); and

a second plurality of spacers (40, 140), each of which can be positioned abutting a side (16, 116) of one of the security bulwarks when the respective security bulwark is mounted along such a perimeter railing and each having a second width (v) which is a fraction of the first width (w).

2. A perimeter protection system according to claim 1, wherein the first plurality (a) of such security bulwarks (1a, 1b, 1c; 119a, 119b, 119c) is arranged side-by-side adjacent to each other and the second plurality (b) of such spacers (40a, 40b; 140a, 140b) is positioned alongside the first plurality (a) of such security bulwarks, the first plurality (a) of such security bulwarks and the second plurality (b) of such spacers abutting each other, whereby the combined width of the first plurality (a) of such security bulwarks and the second plurality (b) of such spacers is substantially equal to (aw + bv).

3. A perimeter protection system according to claim 2, wherein respective ones (40a, 40b; 140a, 140b) of the second plurality (b) of such spacers are each positioned between a respective adjacent pair (1a, 1b; 1b, 1c; 119a, 119b, 119c) of the first plurality (a) of such security bulwarks, whereby the second plurality (b) of such spacers alternates with respective ones of the first plurality (a) of such security bulwarks.

4. A perimeter protection system according to any one of the preceding claims, wherein the second width (v) is less than 10 percent of the first width (w).

5. A perimeter protection system according to any one of the preceding claims, wherein the second width (v) is less than 100 millimetres.

6. A perimeter protection system according to any one of the preceding claims, wherein an adjacent pair of such security bulwarks is connected to each other via a

respective connection device (42, 142) of one or more of such spacers positioned between the adjacent pair of such security bulwarks.

7. A perimeter protection system according to claim 6, wherein the respective connection device (42, 142) comprises a respective through-hole (42, 142) from a respective first side (41, 141) to a respective opposing second side (43, 143) of each of the one or more such spacers.

8. A perimeter protection system according to any one of the preceding claims, wherein a first height (k) of the spacer (40, 140) is less than or equal to a second height (h) of the security bulwark (1, 119).

9. A perimeter protection system according to any one of the preceding claims, wherein a first depth (e) of the spacer (40, 140) is less than or equal to a second depth (d) of the security bulwark (1, 119).

10. A method of protecting a perimeter of a vessel or marine installation, the method comprising:

mounting a first plurality (a) of security bulwarks (1a, 1b, 1c; 119a, 119b, 119c) having a first width (w) side-by-side and adjacent to each other along a perimeter railing (20) of the vessel or marine installation;

positioning a second plurality (b) of spacers (40a, 40b; 140a, 140b) each having a second width (v) which is a fraction of the first width (w) alongside the first plurality (a) of security bulwarks;

abutting the first plurality (a) of security bulwarks and the second plurality (b) of spacers with each other, whereby the combined width (aw + bv) of the first plurality (a) of security bulwarks and the second plurality (b) of spacers is made substantially equal to a length (ℓ) of the perimeter railing.

11. A method according to claim 10, further comprising positioning respective ones (40a, 40b; 140a, 140b) of the second plurality (b) of spacers each between a respective adjacent pair (1a, 1b; 1b, 1c; 119a, 119b; 119b, 119c) of the first plurality (a) of security bulwarks,

thereby alternating the second plurality (b) of spacers with respective ones of the first plurality (a) of security bulwarks.

12. A method according to claim 10 or claim 11, further comprising connecting an adjacent pair of the security bulwarks to each other via a respective connection device (42, 142) of one or more of the plurality of spacers positioned between the adjacent pair of security bulwarks.

13. A method according to claim 12, comprising connecting the adjacent pair of security bulwarks to each other via a respective through-hole (42, 142) from a respective first side (41, 141) to a respective opposing second side (43, 143) of each of the one or more of the plurality of spacers.