

SELF-ACTUATING FLOOD BARRIER

The self-actuating flood barrier is intended as a device for the protection from flooding of buildings and underground facilities such as mass transit railway stations.

Such protection is commonly obtained by constructing the entrances and any other openings leading to the building or underground facility with a threshold level higher than the adjacent ground level, this threshold level corresponding to the highest flood level which it is considered may occur. The disadvantage of this method of flood protection is that in normal use all persons entering or leaving the building or underground facility are inconvenienced by having to ascend and descend the raised threshold level.

Alternative means of flood protection avoiding this disadvantage frequently rely on the use of some form of moving flood barrier, operated either manually or by the use of electrical or other power. When power operation is used, a means of automatic initiation may be incorporated in response to flood level information obtained from sensors. Both manual and automatic methods of operation have disadvantages. Manual operation requires staff to be available at all times to close the barrier whenever a dangerously high flood level is imminent. Automatic operation is vulnerable to the possibility of power or equipment failure.

The invention described here is intended to overcome these disadvantages by providing a moving flood barrier which is self-actuating in operation and does not require any external source of power. The design of the barrier is inherently simple and robust to minimise the possibility of jamming or other operational failure.

The invention consists of a float assembly, the upper surface of which normally lies flush with the threshold level of the entrance to the building or facility to be protected against flooding. The float assembly is pivoted at one end and rises under the action of flood water to form a seal by closing against jambs above the pivoted end and the two adjacent sides.

Additional features may be incorporated to allow a raised water level to be created locally around the float assembly to enable its operation to be tested.



The features of the flood barrier incorporated in its general application are illustrated in the accompanying drawings 1/4, 2/4, and 3/4.

FIGURES 1 and 2 in drawing 1/4 show a longitudinal section and a transverse section respectively through the flood barrier and the float chamber in which it operates.

FIGURES 3 and 4 in drawing 2/4 show enlarged sections through the pivot, illustrating the barrier in the lowered and raised positions respectively.

FIGURES 5 and 6 in drawing 3/4 show enlarged sections through the side panels, also illustrating the barrier in the lowered and raised positions respectively.

An embodiment of the flood barrier, incorporated in the entrance to an underground facility such as a mass transit railway station, is shown in FIGURES 7, 8 and 9 in drawing 4/4. These figures show a plan, longitudinal section and cross section respectively, and illustrate the additional features to permit the testing of the barrier.

A detailed description of the flood barrier with reference to these drawings is provided in the following pages.



FIGURES 1 and 2 show the principal features as generally incorporated in the flood barrier and illustrate its method of operation. The figures show the barrier in the normal, open position, with the float assembly in the closed position superimposed in dotted lines.

The moving part of the barrier comprises a float assembly formed as a sealed watertight box from a threshold plate 1 and other plates 2. The box may be divided into several compartments as shown in FIGURE 2. The plates are preferably of steel, joined by welding, but may be of aluminium or other metal or plastic material.

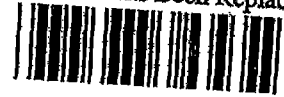
The float assembly operates within a chamber formed by the walls and base 3, which is constructed as a substantially watertight enclosure preferably of reinforced concrete although other materials may be used. The bottom of the chamber is connected to a surface water drain in the vicinity of the flood barrier. In normal conditions with no floodwater the drain, connecting pipe and float chamber remain dry. In flood conditions the drain becomes surcharged, the float chamber fills with water, and the float assembly rises.

The float assembly is pivoted at one end and is supported in its normal position by a nib 5, such that its finished level is flush with the entrance threshold level 6.

The top of the threshold plate is covered other than adjacent to its two sides with concrete or ceramic tiles or other surfacing material 4, to a level matching the surrounding paving.

Inclined jambs 7, as shown by the dashed lines in Figure 1 which illustrate the jamb inclination, are fixed to the inside face of walls projecting above the sides of the float chamber. A jamb is also fixed above the pivoted end of the float assembly, the face of the three jambs lying in the same inclined plane. In flood conditions the float assembly rises until the edges of the threshold plate bear upwards against the jambs, forming a seal against water ingress. The precise location of the float assembly as it bears against the jambs is not critical, provided the mislocation is not so great as to prevent the seal from being made.

The float assembly is so proportioned that as flood water rises, it reaches its fully closed position as shown by the dotted lines in Figure 1 before the water level has risen to the level of the pivot. The barrier is therefore sealed against water inflow as the water level rises above the pivot level.



An enlarged detail of the pivot 9 is shown in FIGURES 3 and 4, and an enlarged detail of the side of the float assembly 10 in FIGURES 5 and 6.

The enlarged pivot detail shows the float assembly in the normal, lowered position in FIGURE 3 and in the fully raised position by the dotted lines in FIGURE 4.

The fixed part of the pivot comprises a channel 11 which is cast in to a nib 12 attached to the structure of the float chamber.

The moving part of the pivot 13 is integral with the float assembly and normally rests on the base of the channel 11.

As the float assembly closes, the moving part of the pivot 13 rises slightly in the fixed channel 11. Sufficient clearances are provided to allow the float assembly to close fully notwithstanding some imprecision in construction and the accumulation of some corrosion products or other debris.

The end jamb against which the float assembly bears when in its closed position comprises an angle plate 14 with gusset plates 15 and a seal 16. The jamb is removable to permit the float assembly to be installed, being held in position by bolts 17 which clamp it to a plate 18 cast in to the nib attached to the wall of the float chamber. Slotted holes may be incorporated to provide adjustment when fixing the jamb in position.

The side jambs, which lie in the same inclined plane as the end jamb, are indicated by the dashed lines 7.

Surfacing material 19, which may typically be ceramic tiling or precast concrete slabs, is installed above the float assembly and the adjacent fixed structure and is typically bedded on mortar 20. Surfacing above the jamb is contained in a removable tray 21 supported on the gusset plates 15. Surfacing above the float assembly is supported by the plates 22.

All parts shown by unbroken diagonal hatch lines are preferably fabricated from steel although aluminium or plastic material may also be used.



The float assembly when in the normal, lowered position bears against a seal 23, which is provided only as a means of excluding dirt and other extraneous material from the float chamber and need not form a seal against water.

The seals 16 and 23 are made from rubber, neoprene, or similar flexible material.

FIGURES 5 and 6 show a detail section through the side of the flood barrier. FIGURE 5 shows the float assembly in the normal, lowered position, and the dotted lines in FIGURE 6 show it in the fully raised position.

A fixed wall 24, in line with the side of the float chamber, projects above the float assembly threshold level. This wall is preferably constructed of reinforced concrete but other materials which form a watertight wall may be used.

The float assembly bears in its raised, closed position against an inclined jamb which is similar in construction to the end jamb previously described. The jamb comprises an angle plate 25 with gusset plates 26 if required for stiffening and a seal 27, and is held in position by bolts 28 by which it is clamped to a plate 29 which is cast in to the wall.

The float assembly includes the plates 1 and 2 with surfacing material 19, 20 as previously described. The float assembly typically has a framework 30 attached above the sides of the threshold plate, supporting cladding panels 31 which mask and protect the inclined jamb. The framework is typically formed of welded steel sections and the cladding panels of coated metal or plastic material. When the float assembly is in the normal, lowered position the top cladding panel bears against a seal 32, which is similar in function and material to the seal 23 previously described.



FIGURES 7, 8 and 9 show a particular application of the self-actuating flood barrier at the entrance to an underground facility such as a station for a mass transit railway. The general size and proportions of the flood barrier in this application may be understood by reference to the steps shown in these figures.

The figures also illustrate the ancillary features to facilitate inspection and testing of the flood barrier.

The entrance threshold level 6 is set higher than the surrounding street level 33, such that it is not necessary for the flood barrier to operate in shallow flood conditions. Entry to the underground facility is obtained by ascending the steps 34 and then descending by the stairs or escalator 35.

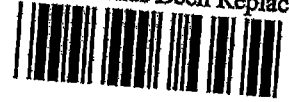
The float assembly formed by the plates 1 and 2 as previously described rises in flood conditions to bear against the jambs and protect against flooding up to a level 8. A wall 36 preferably of concrete but which may be of other material capable of resisting water pressure is provided to surround the entrance and provide complete protection against flooding. This wall forms a continuation of the wall to the side of the flood barrier 24.

The whole entrance is typically surmounted by a canopy 37 to provide protection against rain.

The float chamber 3 is partially below ground level and typically surrounded by soil 38, and is of sufficient size to provide adequate space around and beneath the float assembly for inspection. Man entry to the chamber is obtained by a hatch 39.

The float chamber has no openings in its sides and base except for an orifice 40 which connects to a secondary chamber 41. This orifice is normally open but may be closed by a manually operated valve 42. The secondary chamber is provided with a means of access from street level through a removable grille 43 and is linked by a pipe 44 to a surface water drain serving the street.

In normal circumstances the float chamber and secondary chamber are dry. Under flood conditions water from the surface drain or flowing through the grille enters the float chamber through the orifice, causing the float assembly to rise.



The operation of the flood barrier may be tested by closing the valve 42 and filling the float chamber with water. The float assembly is so proportioned as previously described that it will rise to the fully closed position before flood water has reached the entrance threshold level 6.

The wall surrounding the entrance may be extended beyond the front of the float assembly and provided with vertical slots 45 into which removable stop logs 46 can be inserted. The space between the stop logs and the raised float assembly may then be filled with water up to the flood protection level 8 in order to test the jamb seals.



CLAIMS

1. A flood barrier comprising a float assembly formed from a horizontal or nearly horizontal threshold plate with other plates attached beneath to form a sealed box, the assembly moving within a chamber and so constrained that in conditions of rising flood water it will pivot about one end, the other end rising under the action of water pressure until the assembly bears upwards against a jamb above the pivoted end and inclined jambs above the two adjacent sides.
2. A flood barrier as claimed in Claim 1 in which the size and proportions of the float assembly are so arranged that under the action of rising flood water it will rise to its maximum extent to bear against the jambs before the water level has reached the level of the pivot.
3. A flood barrier as claimed in Claim 1 where in operation the moving part of the pivot rises slightly with respect to the fixed part such that full closure of the barrier is tolerant of some imprecision in its construction and of some accumulation of debris and corrosion products.
4. A flood barrier as claimed in Claim 1 where the chamber in which the float assembly moves can be closed off by a valve to enable it to be filled with water to test the operation of the float assembly.
5. A flood barrier as claimed in Claim 4 in which provision is made for the placing of removable stop logs within slots in walls forming continuations of the side walls of the flood barrier, to enable the space enclosed by the stop logs, the walls, and the float assembly in its raised position to be filled with water to test the sealing of the float assembly against the jambs.
6. A flood barrier as claimed in any preceding claim where the float assembly is made from metal or plastics material or a combination of these materials and which may have as a surfacing on the threshold plate any material which is commonly used for paving purposes.





7. A flood barrier as claimed in any preceding claim in which the side walls and float chamber are made from any material which is substantially watertight and capable of withstanding water pressure equivalent to the level of the flood to be protected against.
8. A flood barrier substantially as herein described and illustrated in the accompanying drawings.

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