

The invention relates to a watercourse barrage and, more particularly, to a coffer dam according to the preamble of claim 1.

This invention relates to the works related to the control or the use of watercourses, streams, irrigation canals, waste-water discharge canals.

There are already known various designs of coffer dams; however, these usually have a number of common features.

Thus, these coffer dams are most often comprised of a vertical movable door slidingly fitted into a supporting structure provided in the apron of a watercourse.

In general, the above-mentioned supporting structure is comprised of an assembling of profiles with a "U"-shaped cross-section and having two parallel stiles, these latter resting, at their lower portion, onto a horizontal sill. Between the parallel legs, oriented towards the median plane of the watercourse, of said stiles with a "U"-shaped cross-section slide the side ends of the movable door. This latter can be made up of one single or several panels which themselves consist of a superposition of hollow metal profiles including, at their upper and lower edges, imbricating means ensuring the tightness at the level of their joining. Stiles, also with a "U"-shaped cross-section, cover the side edges of a set of thus superposed hollow profiles, on the one hand, to ensure their rigid connection so as to form said panel and, on the other hand, to facilitate the sliding of this latter in the stiles of the supporting structure.

FR-A-2,601,054 more particularly relates to a watercourse barrage designed according to the above description. However, in order to guarantee a better tightness of this barrage, seals are arranged, on the one hand, between the lower panel of the movable door and the sill of the supporting structure and, on the other hand, at the side edges of the face, downstream from the thrust of water, of said panels.

These seals the panels are fitted with are intended for cooperating with the inner face of the parallel leg located below of the "U"-shaped profiles forming the stiles of said supporting

structure and this under the action of the water pressure present upstream from the barrage.

However, this thrust of water can prove to be insufficient to cause the compression of the seals sidely located on the panels of the movable door and, in such circumstances, the tightness is not ensured. In order to cope with this disadvantage, it has been foreseen, according to this prior document, to insert clamping means formed by wedge-shaped keys between the leg, located upstream, of the stiles of the supporting structure and the face without seals of the various panels.

As a matter of fact, the aim of such keys is to make sure the cooperation of the side seals of the movable door with the stiles of the supporting structure and, therefore, to break away from the parameter varying according to the installations which is the thrust of the retained water.

However, these keys raise a lot of trouble for both their installation and removing them when cancelling the barrage. It should be noticed that the coffer dams are used in most varying circumstances. They can also be used to interrupt relatively deep watercourses or waste-water ductings. Now, the intervention on the coffer dams is, in such circumstances, particularly difficult. The operators can indeed proceed to the installation of the keys only with appropriate handling means and most often without visibility because of the troubled nature of water. It is indeed confirmed that the operators proceed only very seldom to the installation of such keys, this of course to the detriment of the tightness of the barrage.

There is also known a coffer dam adopting, in a classical way, the configuration of a movable door comprised of one or several superposed panels sliding in a supporting structure comprising, viz., two stiles and a sill formed by profiles with a "U"-shaped cross-section. The tightness of this coffer dam is achieved through seals located, on the one hand, at the level of the joining of the various panels and, on the other hand, between the face, downstream from the thrust of water, of the movable door and the inner face of the leg located in correspondance with the profiles with a "U"-

shaped cross-section forming the stiles of the supporting structure. Furthermore, pressurizing means controlled from the upper end of the coffer dam allow to make sure the co-operation of these seals intercalated between said movable door and said stiles of the supporting structure. More particularly, these pressurizing means are comprised of angle irons one leaf of which applies against the bottom of the "U"-shaped profiles forming said stiles and co-operates, through its front edge, with the rear side edges of the various panels of the movable door. Moreover, in this leaf are made grave-accent-shaped slots serving as a passageway for guiding and holding studs integral with the bottom of the "U"-shaped profile of the supporting structure.

Thus, by exerting from the upper end a downward pressure onto the angle irons, said guiding and holding studs initially move in the horizontal portion of the corresponding slots before sliding upwards in the substantially slanted portion of these latter. This results into a movement with a horizontal component of said angle irons and into a pressure applied onto the rear face of the panels of the movable door causing the compression of the seals intercalated between the front face of these panels and the stiles of the supporting structure.

One easily understands that only recent installations designed for this purpose can be fitted with such pressurizing means. Their application in the stiles of existing supporting structures of coffer dams would entail a considerable reduction of the thickness of the movable door, of course to the detriment of its mechanical strength.

Furthermore, these pressurizing means formed, as described above, by angle irons will find their usefulness only within the framework of undep watercourses. In other cases, the lever arm formed by the distance between the lower end of these angle irons and the actuating organ located at their upper end would be such that a pressure could not be applied onto the movable door.

In addition, from US-A-4,582,451 is known a barrage for watercourses substantially corresponding to the preceding descriptions. Thus,

this barrage includes a vertical movable door the side ends of which are engaged into guiding rails forming the supporting structure. The tightness of this barrage is achieved, on the one hand, through inflatable springy members viz. the side edges, and more particularly the side, located upstream with respect to the watercourse, of the movable door are fitted with. These inflatable springy members are thus capable of co-operating with the wall, located upstream, of the "U"-shaped profiles forming the side grooves in which moves said movable door. The tightness of this latter is achieved, on the other hand, by means of a seal with lips the periphery, and viz. the side edges, of said movable door is fitted with on the side downstream from the watercourse.

Thus, by proceeding to the pressurization of the inflatable members located upstream from the movable door, this latter moves in the side grooves of the supporting structure, so that the seal with lips applies against one wall of said side grooves, whereby it contributes to a better tightness of the barrage or coffer dam.

From the preceding description, one notices that the putting under strain of the tightening means arranged on the downstream side of the movable door is achieved through tightening means located on the upstream side of this latter. These second tightening means, although of a flexible nature, have in no way a sufficient flexibility to push back alone the movable door and to put the seal with lips arranged downstream under strain. Therefore, said tightening means arranged downstream are designed of an inflatable nature so that they assume, by expanding, the function which is assigned to same.

In any case, this arrangement requires a pressurization unit to authorize the inflation of said tightening means. Furthermore, it should be noticed that these latter entail the movable door to be made up of one single panel of a fixed size. It is indeed absolutely necessary to provide a continuity at the level of these tightening means so as to authorize their inflation over their full length. If it is however possible to have the water level vary through such a barrage, this is due only to the installation of a

specific work on the bottom of the apron. This work is however particularly expensive and cannot be implemented within the framework of reduced-size watercourses or which should be obturated only at exceptional occasions.

- 5 The aim of this invention is to cope with the above-mentioned disadvantages. The invention as characterized in the claims solves the problem and consists in a watercourse barrage and, more particularly, a coffer dam comprised of a vertical movable door formed of one or several superposed individual panels and sliding in a supporting
- 10 structure installed in the apron of said watercourse and comprising two parallel stiles formed of "U"-shaped profiles the parallel legs of which are oriented towards the vertical median plane of said coffer dam, tightening means intercalating themselves between the downstream face of the movable door and said stiles of the supporting
- 15 structure, this barrage furthermore including springy means capable of exerting a pressure onto the panels in order to cause the compression of said tightening means, these springy means being formed by either plate springs or helical springs secured to the side edges of the upstream face of the panels, these plate springs,
- 20 respectively helical springs, including rolling means, respectively a shoe, to facilitate their putting under strain when engaging the panels into the stiles of the supporting structure.

The advantages achieved thanks to this invention mainly reside in that the springy means ensure the co-operation of the tightening

25 means with the leg, located downstream, of the stiles of the supporting structure and the side edges of the various panels right from the engagement of these latter into said supporting structure. Moreover, no handling at the bottom of the watercourse is necessary for their implementation.

- 30 Furthermore, such springy means allow to adjust, to large tolerances, the thickness of the movable door with respect to the distance between the parallel legs of the "U"-shaped profiles forming the stiles of the supporting structure. Now, until now this adjustment raised a particularly big problem, viz. within the framework of
- 35 wooden movable doors. Since this material is of a nature tending to

expand during an extended stay in water, too close an adjustment indeed caused the movable door to be clamped; on the other hand, a too reduced thickness of this latter was a source for important leaks, viz. at the beginning of the installation. This invention
5 allows to solve this problem without any trouble, since the springy means are capable of compensating for any, even important, backlash existing between the movable door and said supporting structure. The invention is now described more in detail with reference to drawings showing only one embodiment.

- 10 - Figure 1 is a schematical elevational view of a barrage or coffer dam according to this invention,
- Figure 2 is a cross-sectional view according to II-II of Figure 1,
- Figure 3 is a cross-sectional view according to III-III of Figure
15 1,
- Figure 4 is a view equivalent to Figure 3 and shows a second embodiment of the springy means.

Reference is made to the various Figures.

This invention more particularly relates to a watercourse barrage
20 1, also called coffer dam in that its installation may be of a provisional type and removed at any time.

Thus, this barrage or coffer dam 1 is comprised of a movable door 2 vertically sliding in a supporting structure 3 generally integrated into the apron 4 of said watercourse.

25 More particularly, the supporting structure 3 is comprised of an assembling of profiles with a "U"-shaped cross-section forming two parallel stiles 5, 6 resting, at their lower ends 7, 8, onto a sill 9. The parallel legs 10, 11 of the profiles forming the stiles 5, 6 are oriented towards the vertical median plane 12 of the barrage 1,
30 so as to define slides serving for receiving the movable door 2.

This latter may be of the monolithic type or comprised of several superposed panels 13, 14. This second solution is the most often adopted one within the framework of large-size works of large depth, on the one hand, in order to facilitate the installation of
35 this movable door 2 and, on the other hand, to avoid machinings to

close tolerances. It should however be noticed that because of the features of the invention, this disadvantage regarding the machining tolerances can easily be suppressed. This will become clearer when reading the following.

- 5 Furthermore, in order to adjust the size of the movable door 2 to that of the watercourse, the panels 13, 14 are themselves designed from generally metallic and hollow segments or profiles 15, 16 including, at their upper and lower edges, imbricating means authorizing their superposition while guaranteeing the tightness at the
10 level of their joining.

With a view to conferring some rigidity to the thus made panels 13, 14 and to ensure the connection of the profiles or segments 15, 16, 17, the side edges 18 of these latter are covered by a profile with a "U"-shaped cross-section 19 so that both parallel legs 20, 21 of
15 this latter co-operate with the downstream face 22 and the upstream face 23, respectively, of said panels 13, 14. Since these profiles 19 slide in the stiles 5, 6 of the supporting structure 3, their size and, viz., their thickness 24 will be foreseen substantially smaller than the width 25 of the "U"-shaped profiles forming said
20 stiles 5, 6.

Between the panels 13, 14 may be intercalated a seal, though this latter is not absolutely necessary because of the imbricating means the segments or profiles 15, 16, 17 are fitted with. However, such a seal 26 seems to be necessary between the lower panel 13 and the
25 sill 9 in order to avoid the passing-through of water. This seal 26 will preferably be inserted into the imbricating means 27 present on the lower edge 28 of the segment 15 located at the distal portion of the panel 13.

Likewise, tightening means 29 are intercalated between the inner
30 face 30 of the leg 10, located downstream from the thrust of water, of the stiles 5, 6 and the downstream face 31 of the movable door 2, more particularly, the outer face 32 of the leg 20 of the profile 19 the side edges 18 of the panels 13, 14 are fitted with.

As a matter of fact, this outer face 32 of the leg 20 of the profile 19 has a "T"-shaped groove 33 into which is vertically slid
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the body 34 of an "O"-ring 35 having, at both its edges, a recess into which accomodate themselves the bends 38, 39 of said "T"-shaped groove 33. The head 40 of the "O"-ring 35 applies against the inner face 30 of the parallel leg 10 of the stiles 5, 6.

5 However, in order to avoid a crushing of said "O"-ring 35, the "T"-shaped groove 33 is provided with a protection rim 41 protruding perpendicularly with respect to the outer face 32 of the leg 20 of the profile 19.

To complete this tightness of the coffer dam 1, the movable door 2, and viz. the panels 13, 14 or the supporting structure 3, is provided, according to a feature of the invention, with springy means 42 capable of exerting a pressure onto the upstream face 43, 34 of said movable door 2 and, more particularly, of the panels 13, 14, to cause the compression of the tightening means 28 located downstream.
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These springy means 42 consist, in fact, of helical or plate-type springs intercalating themselves between the inner face 45 of the parallel leg 11, located upstream with respect to the thrust of water, of the "U"-shaped profile forming the stiles 5, 6 of the supporting structure 3 and the upstream face 23 of the panels 13, 14, more particularly the outer face 46 of the parallel leg 21 of the "U"-shaped profile 19 covering the side edges 18 of the segments 15 to 17.
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Thus, according to the preferred embodiment shown in Figures 1 to 3, the springs are plate springs 44 secured, at their lower portion 47, to said outer face 46 of the parallel leg 21 of the profile 19. Moreover, the upper end 48 of a springy nature of these plate springs 44 is curved so as to co-operate with the inner face 45 of the parallel leg 11 of the stiles 5, 6. Advantageously, this upper end 48 of the plate springs 44 is provided with rolling means 49 facilitating the putting under strain of said springs 44 when engaging the panel 13, 14 into the supporting structure 3 and, finally, guarantees a better sliding of the movable door 2 in the stiles 5, 6.
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35 Preferably, a panel 13, 14 includes, at its upstream face 23 and at

the level of each of its side edges 50, 51, at least two springs 44 arranged at different heights. Such a configuration avoids an eventual clamping of a panel 13, 14 in the supporting structure 3, but furthermore ensures a better distribution of the pressure onto the
 5 "O"-rings 35. This obviously results into a better tightness of the whole.

According to another embodiment, the supporting structure 3 and, viz., the stiles 5, 6 are fitted with springy means 42 and, more particularly, with plate springs 44 corresponding to the above de-
 10 scription. These latter adopt, in these circumstances, a reversed position, so that their curved end 48 provided with rolling means 49 does not form a thrust when engaging the various panels 13, 14 into the stiles 5, 6.

This embodiment has however the disadvantage of only difficultly
 15 allowing the fitting of the various existing installations with the features of this invention. The placing of the springy means 42 onto the supporting structure 3 already present in the apron of the watercourse can indeed prove difficult or even impossible.

Figure 4 corresponds to another embodiment of the springy means 42.
 20 These latter are made by means of helical springs 52 secured, at their one end 53, to the outer face 46 of the parallel leg 21 of the profile 19. The other end 54 of these helical springs 52 is provided with a shoe 55 facilitating the engagement and the putting under strain of these springy means 42 in the stiles 5, 6 when
 25 mounting the movable door 2. Therefore, the lower end 56 of this shoe is curved towards the upstream face 23 of the panel 13, 14.

Like before, the number of these helical springs 52 a panel 13, 14 is fitted with will preferably be of four, distributed over the side edges 50, 51 of this latter.

30 Furthermore, the supporting structure may be provided with such helical springs 52 arranged head to foot; in these circumstances, the movable door 2 will be without same. However, such an arrangement can be adopted only provided the constraints when placing the springy means 42 in the existing installations are mitigated.

35 One easily understands from the above description that this inven-

tion considerably facilitates the mounting and dismantling of a movable door 2 of a barrage 1, while substantially improving its tightness.

C L A I M S

1. Watercourse barrage and, more particularly, a coffer dam comprised of a vertical movable door (2) formed of several superposed individual panels (13, 14) and sliding in a supporting structure (3) installed in the apron (4) of said watercourse and comprising two parallel stiles (5, 6) formed of "U"-shaped profiles the parallel legs (10, 11) of which are oriented towards the vertical median plane (12) of said coffer dam, tightening means (29) intercalating themselves between the downstream face (31) of the movable door (2) and said stiles (5, 6) of the supporting structure (3), this barrage furthermore including springy means (42) capable of exerting a pressure onto the panels (13, 14) in order to cause the compression of said tightening means (29), characterized in that these springy means (42) are formed by either plate springs (44) or helical springs (52) secured to the side edges (50, 51) of the upstream face (23) of the panels (13, 14), these plate springs (44), respectively the helical springs (52), including rolling means (49), respectively a shoe (55), to facilitate their putting under strain when engaging the panels (13, 14) into the stiles (5, 6) of the supporting structure (3).
2. Barrage according to claim 1, characterized in that the plate springs (44) are secured, at their lower portion (47), to the side edges (50, 51) of the upstream face (23) of the panels (13, 14) and their upper end (48) is of a springy nature and provided with said rolling means (49).
3. Barrage according to claim 1, characterized in that the helical springs (52) are secured, at their one end (53), to the side edges (50, 51) of the upstream face (23) of the panels (13, 14) and include, at their other end (54), the shoe (55) co-operating with the inner face (45) of the parallel leg (11) of the stiles (5, 6), this shoe (55) being provided with a lower end (56) curved towards said upstream face (23) of the panels (13, 14).
4. Barrage according to claim 1, characterized in that each panel (13, 14) forming the movable door (2) includes at least two helical springs (52) or two plate springs (44) arranged at different



heights at each of the side edges (50, 51) of its upstream face (23).

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