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(54) **River bedload trap**

Falle für Flussbettsedimente

Piège à sédiments de lit d'une rivière

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- **KRISTIN BUNTE ET AL: "Construction of Bedload Traps", 31 May 2007 (2007-05-31), GUIDELINES FOR USING BEDLOAD TRAPS IN COARSE-BEDDED MOUNTAIN STREAMS: CONSTRUCTION, INSTALLATION, OPERATION, AND SAMPLE PROCESSING,, PAGE(S) 5 - 21, XP009166317, ISBN: 978-1-4801-4481-1 * the whole document ***
- **KRISTIN BUNTE ET AL: "Measurement of Coarse Gravel and Cobble Transport Using Portable Bedload Traps", JOURNAL OF HYDRAULIC RESEARCH, INTERNATIONAL ASSOCIATION FOR HYDRAULIC RESEARCH, DELFT, NL, vol. 130, no. 9, 1 September 2004 (2004-09-01), pages 879-893, XP009166007, ISSN: 0022-1686, DOI: 10.1061/(ASCE)0733-9429(2004)130:9(879)**

EP 2 333 161 B1

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Description

[0001] The subject of the invention is a device for trapping bedload dragged on the river bed with the purpose of obtaining thorough knowledge on the phenomenon of the movement of the material, and in particular determining the conditions at the beginning of bedload movement, and intensity of bedload transport.

[0002] The determination of the mass of bedload transported in a river bed during a specified time aims at the assessment of the intensity of bedload movement for the purpose of specifying the morphodynamic, hydrodynamic, and ecological conditions of a river, necessary for undertaking hydrotechnical, and in particular flood control, retention, and energy engineering works.

[0003] The issue of accurate assessment of bedload transport regime concerns particularly mountain rivers transporting significant amounts of bedload. In many cases, the application of direct measurement methods, in particular by means of modern devices, is not possible due to difficult field conditions and lack of infrastructure - electricity supply.

[0004] Both Polish hydrometric practices and measurements of material dragging intensity in American gravel-bed rivers apply sets composed of a container with a pole for its lowering and lifting, system of cords for opening and closing the inlet of the container, and a directional rudder enabling positioning the container parallel to the direction of the water flow. Devices of this type are operated by a researcher directly in a river, or indirectly - from a boat, pontoon, footbridge, or bridge. The presence of a researcher during the measurement limits the time of taking the sample to short time periods, and therefore causes reduction of quality of the measurement results. At high water levels and high turbidity, there is no possibility to control the position of the trap on the river bed, which usually disturbs the measurement. Moreover, the large weight and dimensions of the equipment limit the possibility of its application in the conditions of high-energy mountain rivers.

[0005] The issue is partially solved by the construction of traps stabilized in the river bed by means of steel rods and a metal sheet basis (aluminum ground plate), known from the publication by K. Bunte., S.R., Abt, J.P. Potyondy, S.E. Ryan, Journal of Hydraulic Engineering Yo1.130, No. 9, 2004.

[0006] In greater detail, construction of river bedload trap in river beds is presented in the publication Bunte K. et al: "Construction of Bedload Traps" 31.05.2007 Guidelines for using bedload traps in coarse-bedded mountain streams: CONSTRUCTION, INSTALLATION, OPERATION, AND SAMPLE PROCESSING, XP009166317, ISBN: 978-1-4801-4481-1.

Indicated in this document trap has two steel rods driven into the river bed, an aluminum ground plate seated on the steel rods and an aluminum frame with attached nylon mesh bag. The mesh bag is secured to the frame by inversion of its edge parts around the outer surface of

the frame. Such prepared frame with the secured bag is attached to the steel rods by means of straps guided through the slits in the frame and in the edges of the bag. Outwardly projecting ends of the straps, wrapped around the steel rods make mounting straps, which are further tightened with buckles. Shaft collars are secured above the straps to prevent the straps displacement.

Indicated above the bedload trap is stabilized in the river by two steel rods driven into the bottom. The aluminum frame with secured to it nylon mesh bag is mounted on the rods only by using the plastic straps. With a rapid movement of water, such mounting can be loosened and cause displacement of the frame with the bag, and in the worst case, the bedload trap can flow away with current of the river.

This type of traps proves effective only in the conditions of low-water and sustainable discharges. Their operation in the conditions of flood flow requires minimum three persons securing the bedload trapping device by means of ropes. Replacement of the container requires partial or entire immersion of a researcher under water. In the conditions of mountain rivers, at low air temperatures, it is a serious inconvenience, also limiting the measurement time.

The objective of the invention is to construct a device easy to operate, enabling a thorough insight into the phenomena of river bedload movement in the river channel in any climatic-geographical conditions, in any given time unit, and with the application of continuous measurement procedure.

Particularly, the object of the invention is to provide a device that is fully and firmly stabilized in the bed of the strong current river. In addition, in this device, replacement of the mesh net filled with bedload and installing a new one, should be easy and shouldn't expose the staff into the water immersion.

[0007] The river bedload trap, in accordance with the invention, comprises of at least one element for bedload trapping being stabilized in the channel of the river with a pair of brackets driven into the bottom of the river. This element has a metal body with slide-on on the brackets ears and form a net container for bedload fraction, and this net container is attached to a metal body. The bedload trap is characterized in that, it comprises a stabilizing frame formed of a crosspiece with a hole located in the center thereof, and a threaded rod. The crosspiece is attached to a pair of brackets. Whereas, the threaded rod is attached with the lower end to the upper wall of a metal body and its upper end with a screwed tighten nut is inserted into the hole in the crosspiece. A net container is fastened to the metal body with a clamp yoke. This net container is equipped with a handle, favourably, made of waterproof belt. To the both, net container and the stabilizing frame there are attached strings, and on the ends of all these strings there are clasps, preferably stainless, fastened to a rope stretched on stakes anchored in the riverbanks with rope stay systems.

The net container is waterproof with the net's mesh ad-

justed to the trapped bedload fraction, and this net is favourably strengthened on seams with waterproof tape. The trap, in accordance with the invention, is a portable, light, and comfortable to operate construction enabling carrying out measurements of the mass and volume of river bedload at the same sites and in the same time intervals adjusted to the discharge regime. Measurements with continuous, even 24h monitoring, can be performed irrespective of the environmental conditions of the catchment, and in extreme climatic conditions. Incorporating single building blocks in an additional stabilizing-safety construction anchored strongly in the river banks allows for eliminating the effects of high-energy flood flow discharges, and collisions with drifting parts of trees or ice floats. Owing to situating the vertical and horizontal stabilizing elements over the water surface, the construction of the trap allows for its safe operation irrespective of the river stage.

[0008] The trap, in accordance with the invention, is presented in the picture, where Fig. 1 presents the perspective view of the entire construction.

[0009] The invention is presented as an embodiment. The river bedload trap, shown in Fig. 1 has two elements for trapping bedload, each with pair of brackets 2 driven into the bottom of the river. Each of these elements has a metal body 4 and a net container 1 fastened to that metal body 4 by means of a clamp yoke 3. The metal body 4 has a shape of rectangular frame, which in the top wall has a hole and on the sidewalls, on both sides, has fixed metal ears. Element for trapping bedload comprises a stabilizing frame formed of a crosspiece 5, which in the middle has one hole and at its ends has holes, which slide-on on the pair of brackets 2. In the walls of these outermost holes there are screwed in mounting bolts, which faces, in the course of mounting of the crosspiece 5 to the brackets 2 are squeezed in into the perforation holes in the brackets 2. A threaded rod 6 is attached with its lower end in the hole of upper wall of a metal body 4. Whereas the upper end of this threaded rod 6 with a screwed tighten nut is inserted into the middle hole in the crosspiece 5. Formed in this way stabilization frame, due to tightening or loosening of the tighten nut allows for moving up or down of the metal body 4 and attached to it the net container 1. The net container 1 is waterproof and its equipped with a handle 7 made of water-resistant tape and its net has mesh size of 3.5 mm and is reinforced at the seams with waterproof tape.

To the net container 1 there is attached string 8 and to the stabilizing frame there are attached strings 9. On the ends of these strings 8, 9 there are stainless clasps 10 fastened to a rope 11 stretched on stakes 12 anchored to the banks with rope stay systems.

[0010] Setting the river bedload trap in the river bed is performed by taking the following steps:

- placing and anchoring in the banks of the river two stakes 12 with a rope stay system and stretching a steel rope 11 across the river channel on stakes 12,

- driving into the bottom of the river, in places, where the river bedload will be collected, two brackets 2. These brackets 2 must be driven vertically while maintaining a constant distance between them. In order for proper driving down, it is helpful to connect the two brackets 2 by fixing to them one or two crosspieces 5, and then simultaneous driving into the bottom,
- after driving brackets 2 down- removal of crosspieces 5
- preparation of the net container 1 according to the steps given below:
- securing the lower end of a vertical threaded rod 6 to the upper wall of the metal body 4 and screwing on the tighten nut on the upper end of the rod,
- sliding the net container 1 on the edge of the metal body 4, installation of the clamp yoke 3 and tightening up,
- inserting, from the top, so prepared metal body 4 with the net container 1 on the brackets 2, by sliding the metal body's ears on the brackets 2,
- inserting the crosspiece 5 on the brackets 2, while directing the upper end of a vertical threaded rod 6 into the hole in the middle of the crosspiece 5,
- fixing the crosspiece 5 by screwing the screws into the holes in the brackets 2 perforations,
- moving the body 2 with the attached container 1 to the bottom of a river, which is effected by tightening the clamping nut, screwed onto the upper end of the rod 6, till resistance of the bottom surface of the crosspiece 5,
- installation of the clasps 10 on the rope 11, - this is the final step.

[0011] Replacing the filled container 1 with another one requires unscrewing the tighten nut, removing the nuts and removing the crosspiece 5, then, during lifting the handle 7, pulling out the filled container 1 together with the body 4.

The disconnection of the filled container requires release of the yoke clamp 3, then it is possible to slide the empty container 1 and, in the reverse order setting in the river.

45 Claims

1. A river bedload trap for being installed in river beds, the trap comprising
 - a pair of brackets (2),
 - a metal body (4) with ears to slide on the brackets (2),
 - a net container (1) attached to this metal body (4),

characterized in that, the trap additionally comprises

- a stabilizing frame formed of a crosspiece (5) with a hole and a threaded rod (6), wherein in an installed state the crosspiece (5) is attached to the pair of brackets (2), and the threaded rod (6) is attached with its lower end to the metal

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and

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- stakes (12) for being anchored in river banks,
- a rope stay system for stabilizing the stakes,
- a rope (11), which in an installed state is stretched across the stakes,

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and

- a first string (8) attached with one end to the net container (1),
- second strings (9) attached with one end to the stabilizing frame (5),

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wherein on the other ends of these first and second strings (8,9) there are clasps (10), preferably stainless, which clasps in an installed state are fastened to the rope (11).

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2. The bedload trap according claim 1, **characterized in that**, the net container (1) is attached to the metal body (4), by means of a clamp yoke (3).
3. The bedload trap according to claim 1 or 2, **characterized in that**, the net container (1) is equipped with a handle (7), favourably, made of waterproof belt.
4. The bedload trap according to the preceding claims, **characterized in that**, the net container (1) is waterproof with net mesh size adjusted for trapped fraction and the net is reinforced at the seams with waterproof tape.

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Patentansprüche

1. Falle für Flussbettsedimente die aus den folgenden Elementen besteht:

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- ein Paar der Stützkonsolen (2),
- Metallkörper (4) mit den auf den Stützkonsolen aufgeschobenen Ösen (2)
- an diesem Metallkörper (4) befestigter Netzbehälter - Netzkorb (1),

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dadurch gekennzeichnet, dass er zusätzlich wie folgt umfasst:

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- ein stabilisierender Rahmen der aus einem

Querholm (5) mit einem Loch und einem Gewindestab (6) besteht, wobei im montierten Zustand der Querholm (5) am Paar der Stützkonsolen (2) befestigt ist, wobei das untere Ende dieses Gewindestabes am Metallkörper (4) befestigt ist und wobei das obere Ende des Gewindestabes ins Loch im Querholm (5) eingeschoben ist, und wobei dieses obere Ende des Gewindestabes mit einer Befestigungsmutter im genannten Loch befestigt ist, und

- Pfähle (12) die an den Flussufer verankert sind,
- Seil-Verankerungs-System zur Stabilisierung der Pfähle,

- Seil (11) das im montierten Zustand auf den Pfählen erstreckt ist und

- das erste Seil (8) mit einem Ende das an dem Netzbehälter befestigt (1) ist,

- das zweite Seil (9) mit einem Ende das am Stabilisierungsrahmen (5) befestigt ist, wobei das erste und zweite Ende von diesen ersten und zweiten Seilen (8, 9) mit Karabinerhaken - vorzugsweise aus einem Edelstahl - versehen sind, die an das Seil (11) zugeschnallt sind.

2. Falle nach dem Anspruch 1, **gekennzeichnet dadurch, dass** der Netzbehälter (1) an dem Metallkörper (4) mittels einer Klemmbügel (3) befestigt wird.

3. Falle nach dem Anspruch 1 oder 2 gekennzeichnet dadurch, dass der Netzbehälter (1) mit einem, vorzugsweise, aus einem wasserechten Band ausgeführten Halter (7) ausgestattet ist.

4. Falle nach den vorherigen Ansprüchen **gekennzeichnet dadurch, dass** der Netzbehälter (1) wasserecht ist und ist mit einem Netz von den der gefangenen Flussbettsedimente-Fraktion angepassten Maschen versehen, wobei dieses Netz an den Nähten mit einem wasserechten Band verstärkt ist.

Revendications

1. Piège à sédiments de lit d'une rivière, comportant

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- une paire de supports (2),
- un corps métallique (4) avec des oreilles introduites sur les supports (2),
- bac grillagé (1) fixé à ce corps métallique (4),

caractérisé en ce qu'il comprend en outre

- un encadrement stabilisant formé d'une traverse (5) avec un orifice et d'une tige filetée (6), la traverse (5) étant en état assemblée, fixée à la paire des supports (2) et la tige filetée (6) est fixée par son extrémité inférieure au corps métallique (4), et sa extrémité supérieure est intro-

duite dans l'orifice de la traverse (5) et équipée d'un écrou de serrage, et

- des pieux (12) ancrés aux berges de la rivière,
- un système câblé de haubans pour la stabilisation des pieux, 5
- un câble (11), qui en état assemblé est étendu entre les pieux, et
- un premier câble (8) fixé par une extrémité au bac grillagé (1),
- un second câble (9) fixé par une extrémité à l'encadrement stabilisant (5), 10

où sur les deuxièmes extrémités de ces premiers et seconds câbles (8, 9) se trouvent des mousquetons (10) avantageusement inoxydables, accrochés au câble (11). 15

2. Piège selon la revendication 1, **caractérisé en ce que** le bac grillagé (1) est fixé au corps métallique (4) à l'aide d'un collier de serrage (3). 20
3. Piège selon les revendications 1 ou 2, **caractérisé en ce que** le bac grillagé (1) est équipé d'une poignée (7) exécutée avantageusement d'un ruban imperméable. 25
4. Piège selon les revendications précédentes, **caractérisé en ce que** le bac grillagé (1) est hydrofuge, avec une grille à mailles adaptées à la fraction piégée de sédiment, et la grille est renforcée sur les soudures par un ruban imperméable. 30

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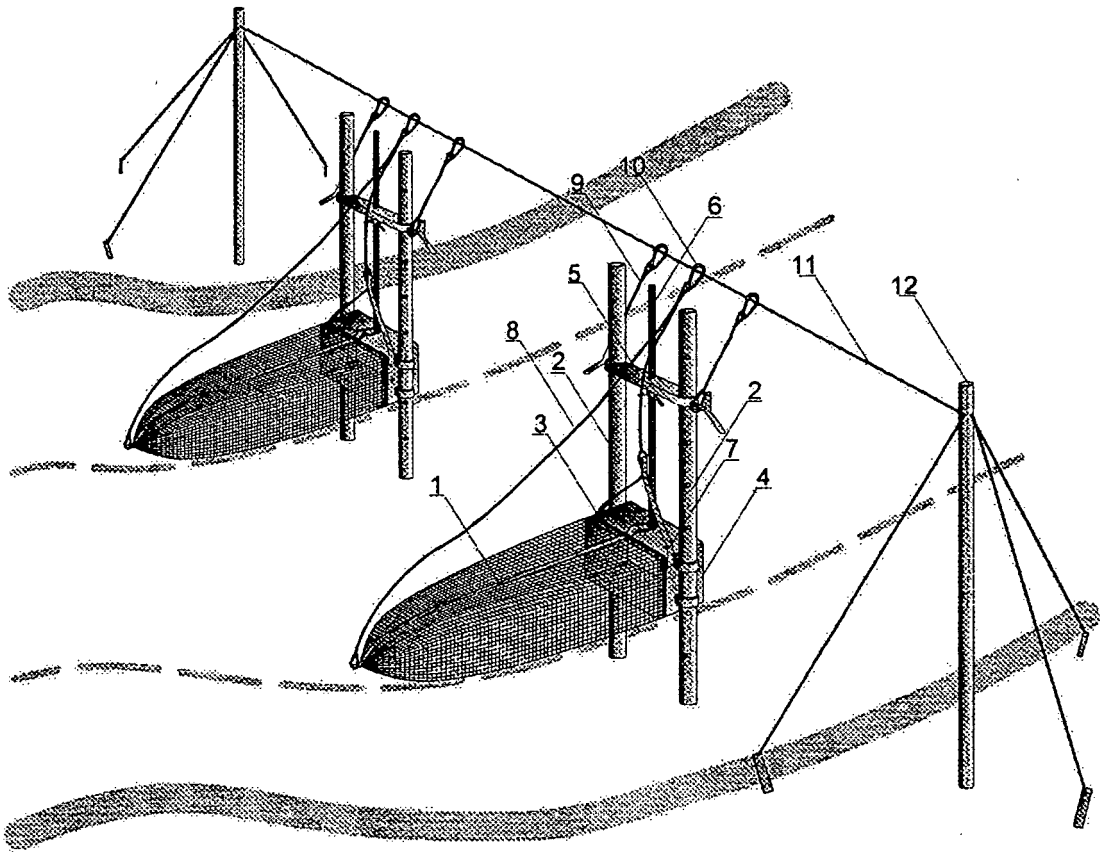


Fig. 1

REFERENCES CITED IN THE DESCRIPTION

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Non-patent literature cited in the description

- **K. BUNTE. ; S.R., ABT, ; J.P. POTYONDY, ; S.E. RYAN.** *Journal of Hydraulic Engineering*, 2004, vol. 130 (9) [0005]
- **BUNTE K. et al.** Construction of Bedload Traps. *Guidelines for using bedload traps in coarse-bedded mountain streams: CONSTRUCTION, INSTALLATION, OPERATION, AND SAMPLE PROCESSING*, 31 May 2007, ISBN 978-1-4801-4481-1 [0006]