# FLOWMETER FOR WATERED FURROWS

**C. NICOLESCU**[1], **Gh. ŞOVĂIALĂ**[1], **D. BUCUR**[2], **Gabriela MATACHE**[1]

[1] The National Research and Development Institute for Optoelectronics 2000 - Branch: The Hydraulics and Pneumatics Research Institute Bucharest (INOE 2000-IHP), *e-mail: ihp@fluidas.ro*

[2] University of Agricultural Sciences and Veterinary Medicine Iasi

*The device serves to measure the flow since furrows of trapezoidal section, with the following characteristic elements: the little down base =11 - 20 cm the big above base of 50 - 60 cm depth in consideration with the stuffing of 18 - 30 cm and the inclination of the slopes m =1.5 The flowmeter is composed of two metal sections with variable cross section, the first from the trapezoidal form until a triangle form with down top and the second from a triangle section to a trapezoidal form. The first section is provided with a metal shutter for the emending in the slopes of the furrow. To stabilize the flow regime, up the downstream of flowmeter, the furrow is shark with a waterproof film. The technique solution is the subject of the patent application for invention a/2006/00101. The construction of the product is simple, reliable without mobile parts. The maximum possible measured flow is up to 5 $dm^3/s$.*

***Key words**: irrigation, furrow, flowmeter*

The product is a flowmeter used for making measurements on furrows in various sections on their length. This flowmeter is used in agriculture, in the surface leakage irrigation technique.

## MATERIAL AND METHOD

The furrows are watered by means of an installation for irrigation which has the role of carrying the necessary amounts of water to the plants, from the hydrant of the last supplying pipe from the zone, through pipes equipped with delivery elements, till the furrow top.

Usually the furrow has a trapezoidal section with the following characteristics: the small bottom base $a$ = 11 - 20 cm, the big top base 50 - 60 cm, the depth taking into account the filling $H$ = 18-30 cm, the slope inclination $m$ = 1,5.

In the experimental technique it is known a flow meter with trapezoidal section and strangling used for measuring the flow on furrow, studying infiltration in its dynamic.

The flow results from the relationship between the constructive parameters of the device and the height of the water spout discharged, measured close and upstream the overflow. This device has the following disadvantages:

- Low accuracy as a result of the shape of the section in its measured point;
- Does not reach the stabilization of the flowing;
- Does not eliminate the lateral infiltration and/or behind the flowmeter.

This may represent a suitable solution for reaching higher accuracy in finding the watering flow value.

## RESULTS AND DISCUSSIONS

The component parts of the flowmeter are shown in *figures 1 - 3*.

It is composed of two metallic sections with variable transversal cuts the first from a trapezoidal shape equal to a furrow section till a triangular shape with the top down, section in which is provided with a frontal overflow formed of a thin wall and a sharp edge placed at a constant height. This has below a point for performing measurement with a graduated ruler, continuing with the second section which varies from a triangular shape to a trapezoidal one. Upstream the first metallic section, mounted on the furrow section has a metallic shutter for being fixed in the furrow and for stabilizing the flow upstream and downstream of the flowmeter the furrow is coated with a waterproof sheet.

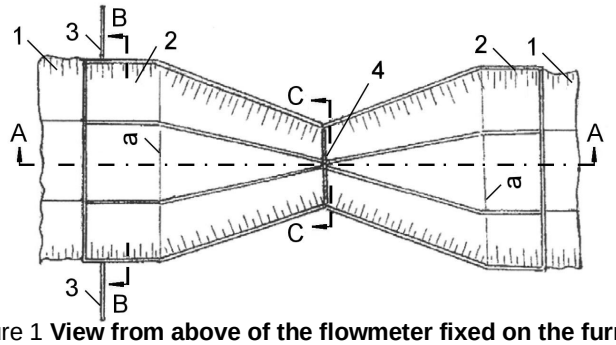


Figure 1 **View from above of the flowmeter fixed on the furrow**

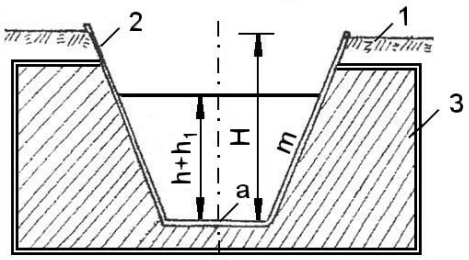


Figure 2 **Transversal section according with the plan B - B**

The flow for furrows has the shape of a furrow with variable section, from a trapezoidal shape to a triangular one and then again trapezoidal.

The characteristics of the first furrow section are: a constant height (*H*) and a trapezoidal shape with the small base down, of size (*a*) and the big base upside at the level of the opening at the crowning, determined by the inclination (*m*) of the slope.

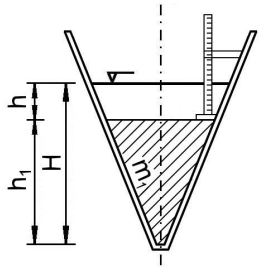


Figure 3 **Transversal section through the overflow according to plan (C - C)**

The flowmeter is composed of 2 metallic sections with variable transversal cut, the first of trapezoidal shape equal with the form of a furrow section (*1*) till a triangular shape with the top down, section in which is provided with a frontal overflow (*4*) formed of a thin wall and a sharp edge placed at a constant height ($h_1$) a point for performing measurements with a graduated ruler (*6*) continuing with the second section (*2*) which varies from a triangular section to a trapezoidal one the section (*2*) being symmetrical in the mirror with the overflow (*4*) Upstream and downstream the flowmeter for stabilizing flow the furrow is coated on a certain length with a water proof sheet (*7*) Upstream the first metallic section of (*2*) mounted on the furrow section (*1*) is provided with a metallic shutter for being fixed in the furrow on a certain breadth on both sides. The shutter allows fixing the flowmeter in the furrow (*1*) and eliminate lateral and beyond infiltrations.

In the same purpose the free space between the flowmeter (*2*) and the furrow slopes (*1*) close to the overflow may be filled with earth which is easily compacted.

The height (*h*) of the water spout which discharges is measured in the point (*5*) with the graduated ruler (*6*) and which is used for determining the flow.

The main advantages are as follows:

- Simple, fiable construction without mobile components;
- Light weight being possible to be carried by a person;
- High degree of mobility being possible to be installed in any point from the furrow line;
- Various material for construction: plastic or iron plate;
- The performance reached by these method and watering installation was registered in real conditions and are according to the ones included in the documentation.

## CONCLUSIONS

1. The flowmeter reaches variation of the transversal cut in the order trapezoidal triangular trapezoidal by maintaining the height (*H*) constant and by variation of the small base (*a*) the slope ($m$, $m_1$) and of the big base the opening at crowning.

2. The main advantages are the following:

- The accuracy of measuring the water spouts +/- 1% and of the flow +/- 5% the max. flow possible to be measured is of about 5 dm3/s;

- It exists the possibility to monitor the distributed volumes, and be made interventions if necessary for reducing losses caused by infiltrations under the watering depth and implicitly reducing with 10 - 20 % the raw norm of irrigation;
- High quality use of irrigation water as a result of determining the flow accurately;
- Know the uniformity of distribution of the water on the furrow length this making possible to find solutions for improvement, such as levelling, watering plots differentiation soil volumes depth of execution.

For this flowmeter was submitted application for being granted patent of invention no. a/2006/00101.

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