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A NEW APPROACH TO TEACHING HYDRAULICS IN ENGINEERING FIELDS

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Abstract
This article presents ideas on organizing new experimental work using modern equipment and analyzing the results in teaching hydraulics.

Keywords: Experiment, flow, reversal, pipe, steady flow, meter, piezometer, excess air, irrigation system, chemical industry, agricultural industry, machinery, pump, compressor.

Introduction

Hydraulics also deals with the application of the laws of force distribution in fluids and their changes during movement to the calculation and design of various devices and machines.

Is also the basis of a number of sciences, such as hydraulic engineering, irrigation, water supply and sewage, and petroleum mechanics. Since the earliest times of human history, the use of water has played a certain role in life. There is information about the construction of ships, aqueducts, water pipes and irrigation systems in ancient China, Egypt, Greece, Rome, Central Asia and other primitive civilizations. The remains of these devices have been preserved to this day. The scientific works of the great mathematical and mechanical scientists L. Euler, D. Bernoulli, M. Lomonosov, and Lagrange, who lived in the 17th-18th centuries, provided a great foundation for the development of science.

Modern hydraulics is a science that develops by connecting theory with experiment, testing theoretical verifications in experiments, and generalizing experimental results on a theoretical basis, and using the methods and achievements of hydromechanics in its investigations .

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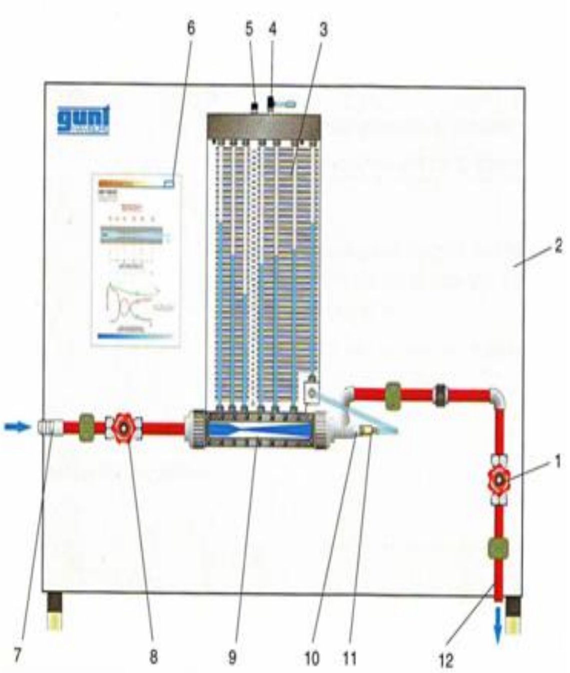
Modern irrigation systems, the chemical industry, the agricultural industry, and many other areas of engineering are unimaginable without pumps, compressors, hydraulic transmissions, and other hydraulic machines.

In order to ensure the implementation of Order No. 766 of October 16, 2017 "On the assessment of the effective use of educational and laboratory equipment supplied to higher educational institutions", educational laboratory equipment manufactured by the Guni company in Hamburg, Germany, was delivered to many higher education institutions in our country.

One of the laboratory equipment is Bernoulli's theorem (HM 150.07) , which allows you to determine the pressure change of liquids moving in pipes and build a special graph. The laboratory equipment is designed to be simple and understandable. Students can visualize the pressure generated in pipes and clearly show the changes occurring in it due to external and internal influences.



1. drain cock
2. learning panel
3. 7-tube monometer
4. check valve
5. relief valve
6. information panel
7. water supply hose connection point
8. inlet valve
9. six-point venturi nozzle with pressure gauge
10. gland packing
11. measuring probe for total pressure (by axial movement)
12. output part

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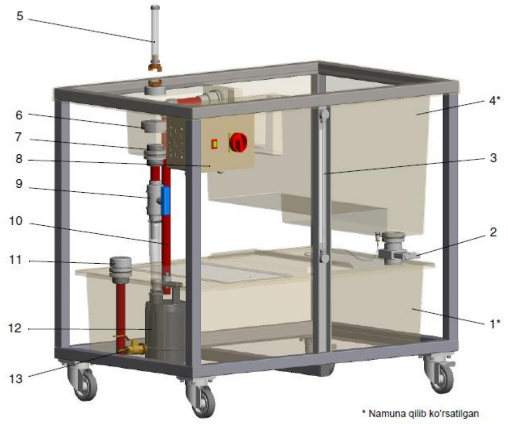
Bernoulli's Theorem (HM 150.07)

When using the laboratory equipment, **the HM 150** basic module intended for conducting experiments in the field of fluid mechanics is also used.



1. Water tank with shelf
2. Sliding door lock
3. External water level sensor
4. A measuring vessel with a channel through which the volume of a water flow is measured
5. Water pumpless
6. How big is the measuring cup?
7. The tube that connects to the pump
8. Outer button
9. Shut-off valve that corrects consumption
10. A tool that controls the casting
11. Connecting the water supply line to the pump
12. Electric sump pump
13. Water dispenser

We start the experiment by reversing the flow. To do this, a stable flow is created along the pipe, excess air in the pipe and in the measuring piezometers is removed. To do this, the liquid is removed using the drain valve (4) and the release valve (5) **shown in the HM 150.07 module**. It is ensured that the readings of the piezometers installed in the pipe show a uniform lower value. The liquid is stopped by pressing the external button of the pump. When restarting the experiment, we also start the stopwatch to determine the flow rate.

When the flow is resumed, the valve in the flow channel and the valve in the discharge channel are opened at the same time. As a result, the flow stabilizes and the pressure heights for 6 sections are formed in the piezometers. We determine these values according to the values on the tube board.

For each section, we write down the values of the heights, these values give the static pressure of the fluid flowing in the pipe at the point - P_{stat}. We write down the values in Table 1 below.

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Table 1

P - stat	**1**	**2**	**3**	**4**	**5**	**6**

Then we can determine the total (total) pressure of the flow at the points. For this, the HM 150.07 module is shown For total pressure, we move the end of the measuring probe (by axial movement)-(11) metal tube to the first section column in the pipe and, observing a z, record the piezometer value that determines the total pressure. We repeat this for each of the 6 sections and record the values in Table 2 below:

Table 2

P total P is complete.	**1**	**2**	**3**	**4**	**5**	**6**

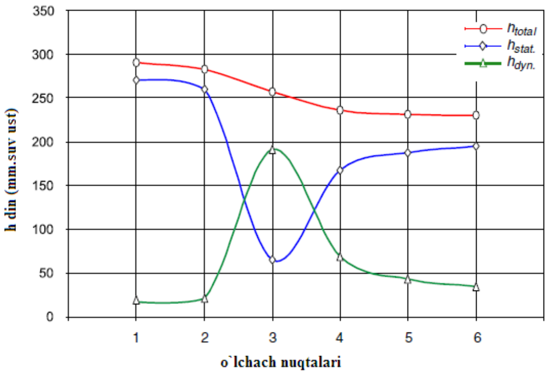
According to the experimental results, the values of static and total pressure in the pipe sections were found. Now, using the formula below, we can determine the dynamic pressure in the pipe sections:

$$P_{dynamic} = P_{full} - P_{stat}$$

We write the calculation results in Table 3 below:

Table 3

P dynamic	**1**	**2**	**3**	**4**	**5**	**6**



Plotting the pressure graph at points We take a plane 00 and mark 6 measuring points. We put a scale of pressure heights on a vertical column. We determine the

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pressure height values corresponding to the points. We connect the ends of the 6 points. As a result, a piezometric graph of pressure heights at the points is formed. From this graph, it will be possible to analyze the state of pressure increase or decrease.

In conclusion, it can be said that, According to Bernoulli's theorem for fluid flow, the values of the dynamic- P dynamic ; total-P total ; static-P stat pressures at points are different. Pressure losses are observed between sections. These losses occur along the pipe and due to local resistances.

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