



# EQUIPMENT

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# BOILER GAS WATER HEATING MODULAR WITH UTILIZER OF HEAT OF EXHAUST GASES KVMU-1,25GN

## **Appointment:**

For heating and hot water supply of residential, industrial and administrative buildings in closed heat supply systems.

## **Advantages:**

- ✓ relatively low cost;
- ✓ payback period up to 12 months;
- ✓ support the highest possible efficiency ( $\eta = 98\%$ ) throughout the load range of the boiler;
- ✓ the modular design allows the boiler to use each module separately;
- ✓ besides producing heat boiler has a possibility of electricity.

## **Efficiency:**

- ✓ gas savings of up to 40% compared to obsolete boilers;
- ✓ reduction of NOx emissions by 40% and complete absence of CO emissions.

**Patents of Ukraine:** № 102363.

## **Implemented in 2013:**

KP "Kharkivteplomerezha".



## **Basic technical characteristics**

Nominal heat productivity, MW	1,25
Fuel consumption (natural gas), m <sup>3</sup> / h	136
Burner type	GBGM-1,4 ND
Working pressure of the heat carrier, MPa	0,6
Range of regulation of heat productivity, %	40...100
Heat carrier consumption, m <sup>3</sup> / h	5...16,5
Hydraulic resistance of a boiler, not more kPa	50
Estimated service life, year	15

# BOILER SOLID FUEL WATER HEATING UNIFIED KVV-0,5T

## **Appointment:**

For heating and hot water supply of residential, industrial and administrative buildings in closed heat supply systems.

## **Advantages:**

- ✓ combustion of various types of solid fuels;
- ✓ use of burners according to different principles of operation;
- ✓ payback period up to 18 months;
- ✓ support of the maximum possible efficiency (not less than 85%);
- ✓ design allows you to quickly replace the basic elements of the boiler.

## **Basic technical characteristics**

Nominal heat productivity, MW	0,5
Type of fuel	wood chips, wood pellets, combined pellets
Fuel consumption per 1 Gcal:	
wood chips, kg / h	340
wood pellets, kg / h	290
combined pellets, kg / h	260
The minimum temperature of the exhaust gases, °C	<240
Range of regulation of heat productivity, %	40...100
Estimated service life, year	>10



## **Efficiency:**

- ✓ replacing the use of natural gas with solid fuel;
- ✓ reduction of NOx emissions to 500 mg / m<sup>3</sup> and CO emissions to 250 mg / m<sup>3</sup>.

## **Implemented in 2017:**

TVD "Brovary plant of municipal equipment".

# HEATING AND COOKING OVEN "RECORD" (HCO - 1)

## **Appointment:**

For heating of living and auxiliary premises up to 40 m<sup>2</sup> and for cooking.

## **Advantages:**

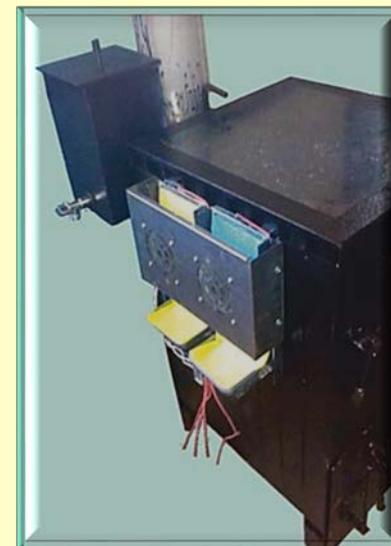
- ✓ maintaining the set temperature in the room (16... 20 °C) with minimal fuel consumption;
- ✓ furnace equipment allows to produce electricity 12V, up to 100W;
- ✓ support of the maximum possible efficiency (not less than 75... 80%).

## **Efficiency:**

- ✓ almost 95% of fuel combustion is provided;
- ✓ the amount of NO<sub>x</sub> emissions and CO emissions decreases.

## **Implemented in 2014-2017:**

Armed Forces of Ukraine.



## **Basic technical characteristics**

Nominal heat productivity, kW	2...4
Type of fuel	wood, lignite, peat, briquettes, pellets, grasses, straw, wood chips
Maximum volume of loaded fuel, dm <sup>3</sup>	20
Heating area, m <sup>2</sup>	20...40
Efficiency, %	75...80
Emission of pollutants, CO / NO <sub>x</sub> , mg / m <sup>3</sup>	1700/50
Weight, kg	50
The minimum height of the chimney, m	3

# KVVD-0,63 Gn Boiler



**Patent of boiler KVVD-0.63 Gn:**  
№ 70831A.

**Patent for invention** № 66024/24.

## **Appointment:**

Heating water-heating water-pipe-smoke boiler with a heat capacity of 0.63 MW is intended for use in heating and hot water supply systems.

## **Efficiency:**

Heating hot water fire-and-water-tube boiler of 0.63 MW capacity. Implementation of the boiler enables to replace the outdated “Minsk-1”, “NIISTU-5”, “Universal”, “Energy” etc. boilers, to increase twice heating capacity of a boiler-house with- out changing its building, to increase substantially the efficiency and reliability of heat supply sources.

## **Basic technical characteristics**

Nominal heat productivity, MW	0,63
Efficiency,%, not less (actual at rated load - by 66% - 94.8%)	92 - 93,1%
Specific fuel consumption, nm <sup>3</sup> / MW, no more	115,5
Water temperature at the boiler output °C	95

# KVV-2,0 Gn Boiler



**Patent for invention** № 81025.

## **Appointment**

Heating water-heating water pipe boiler with a heat output of 2.0 MW is designed for use in heating and hot water supply systems.

## **Efficiency:**

Implementation of the boiler enables to increase heating capacity of a boiler-house 2-3 times without changing its building.

## **Basic technical characteristics**

Nominal heat productivity, MW	2,0
Efficiency,%, not less (actually at rated load - 93%, 50% - 95%)	92
Specific fuel consumption, m <sup>3</sup> / MW, no more	110
The content of nitrogen oxides (in terms of NO <sub>2</sub> ) in dry combustion products (reduced to $\alpha = 1$ ), mg / m <sup>3</sup>	96 -130
Water temperature at the boiler output, °C	95
Flue gas temperature, °C	90 - 180

# RECONSTRUCTION OF "NIISTU-5" BOILER

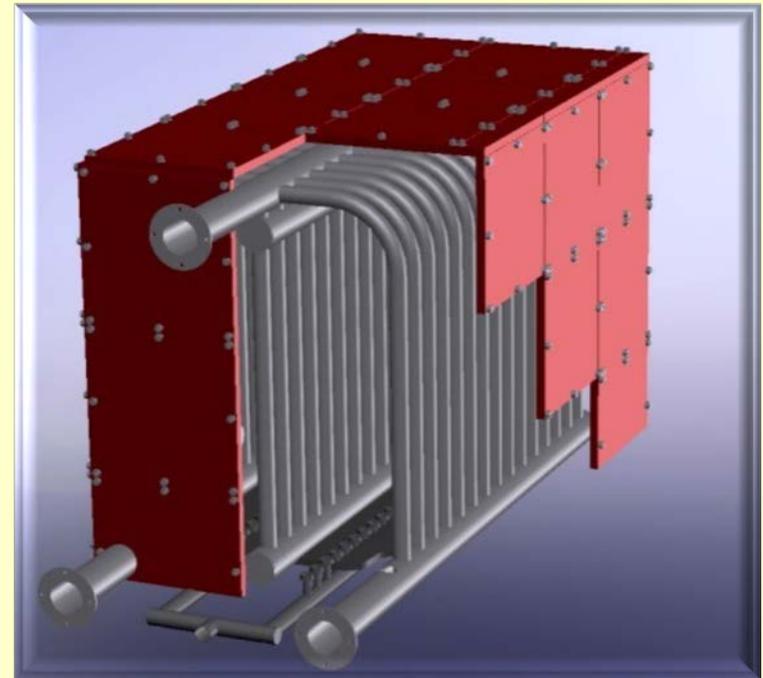
## **Appointment:**

Reconstruction of "NIISTU-5" boiler with installation of the double-side water-tube screen, additional convection surface and light heat insulation. The reconstruction will increase boiler efficiency by 10 ... 12% and reduce natural gas consumption by 40 thousand m<sup>3</sup> / year.

## **Efficiency:**

Estimation of capital investments in boiler reconstruction taking into account the cost of an additional heat exchange surface of about UAH 40,000. The payback period for reconstruction costs does not exceed two years.

**Patent for Utility Model** № 93801.

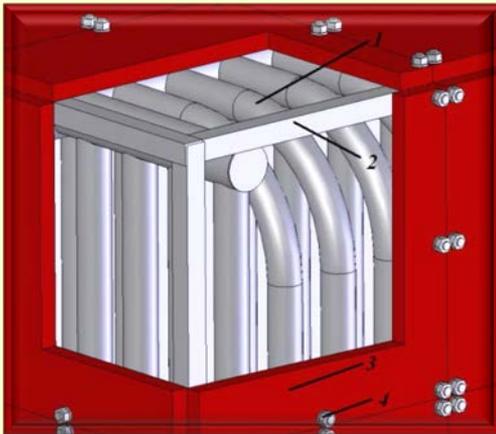


## **Basic technical characteristics**

Nominal heat productivity, MW	0,89 Gcal / h
The temperature of the exhaust gases	127 °C
Boiler efficiency	92,4%
CO content (at $\alpha = 1$ )	90 mg / m <sup>3</sup>
NOx content (at $\alpha = 1$ )	134 mg / m <sup>3</sup>
Calorific value of fuel	7960 kcal / m <sup>3</sup>

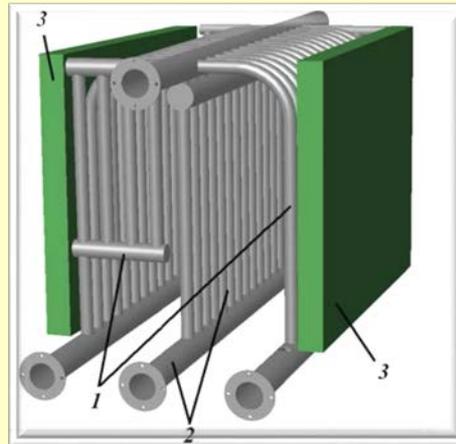
# CONCEPT OF NIISTU-5 BOILER MODERNIZATION (Efficiency 93%)

**Thermal insulation of the boiler with basalt fiber plates PZhTZ-19**



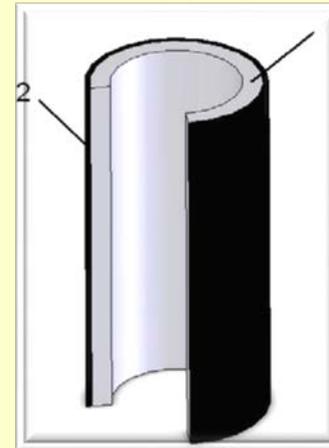
1- boiler, 2-frame, 3 - insulation, 4 - fastening

**Installation in the boiler furnace two-light screen screen and efficient convective surfaces**



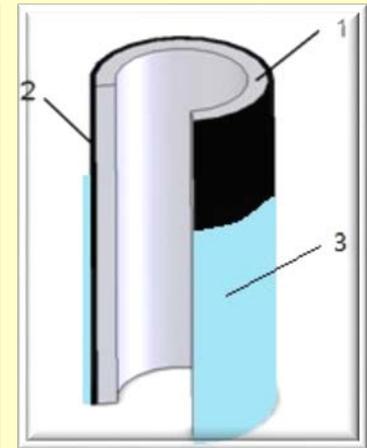
1- pipe part of the boiler, 2- intermediate screen, 3- convective surface

**Heat-absorbing coating**



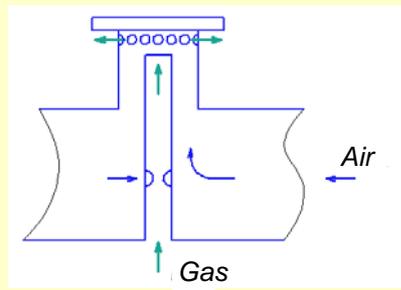
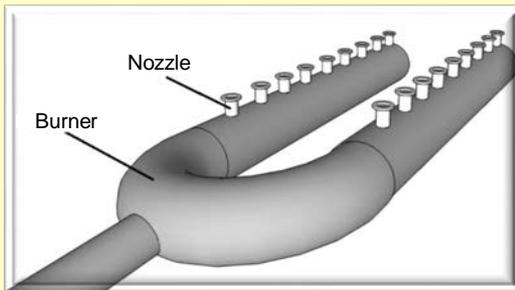
1- pipe, 2 - coverage (varnish KO + Al<sub>2</sub>O<sub>3</sub>)

**Anticorrosive coating**

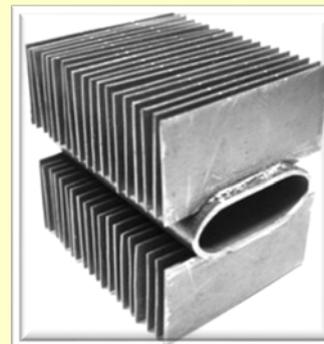


1 - pipe, 2 - coverage (varnish KO + Al<sub>2</sub>O<sub>3</sub>)  
3 - coverage (varnish KO)

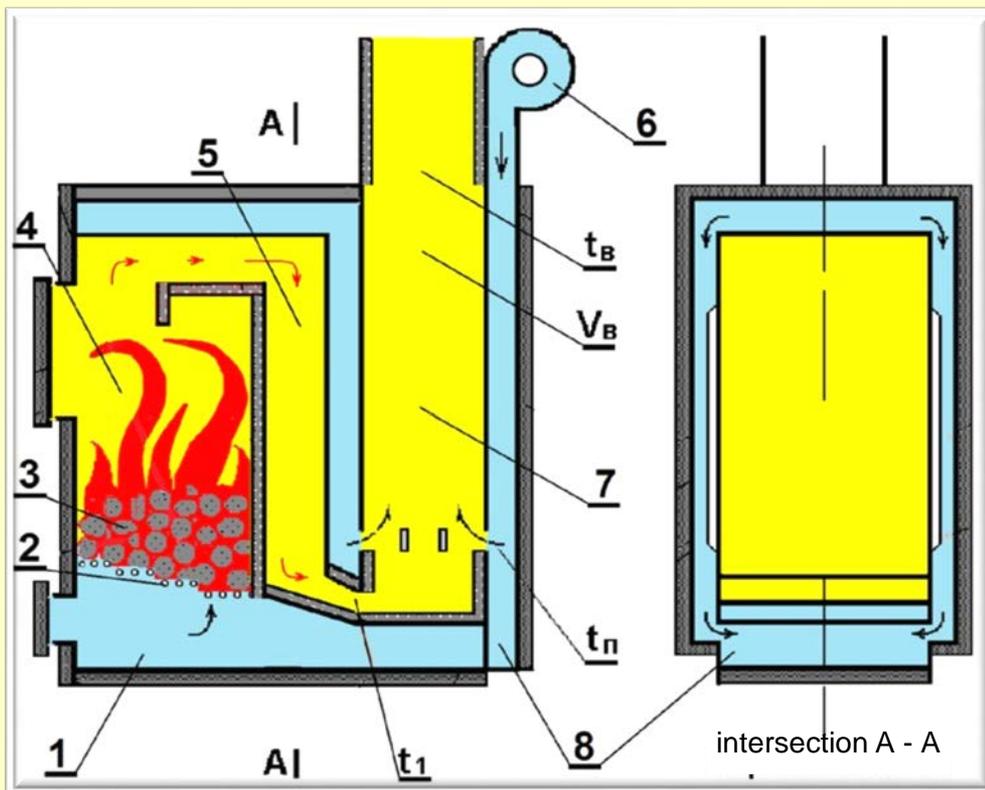
**Hearth, multi-nozzle radiation burner**



**Highly efficient pipes of different geometries with complete and incomplete finning**



# FURNACE FOR BALL COMBUSTION OF SOLID BIOMASS



1 - ashtray; 2 - lattice; 3 - fuel; 4 - primary combustion chamber; 5 - lowering channel; 6 - fan; 7 - afterburner; 8 - air heating channels.

**Patent of Ukraine:** № 74689.

## **Appointment:**

Heating of domestic and industrial premises, cooking.

## **Advantages:**

Two-stage combustion, developed surfaces of preheating of air, presence of a flue with lowering movement of gases.

## **Efficiency:**

- ✓ possibility to use cheap local fuels;
- ✓ no violation of sanitary norms on CO and NOx.

## **Basic technical characteristics**

Height, m	1,2
Width, m	0,9
Depth, m	1,4
Heat power, kW	10 - 30

# SECONDARY RADIATOR FOR BOILER COMBUSTION CHAMBER



The main technical characteristics of the secondary emitter are developed for the combustion chamber of each boiler individually.

**Patents of Ukraine:** № 81487, 95495.

**Implemented in 2013:** KP "Kharkivteplomerezha".

## **Appointment:**

For intensification of heat exchange (heat transfer) in furnace chambers of boilers.

## **Advantages:**

- ✓ payback period up to 3 months;
- ✓ allows to modernize a furnace space of a boiler with the smallest expenses;
- ✓ the service life of the boiler is extended;
- ✓ the efficiency of the boiler increases by 3%.

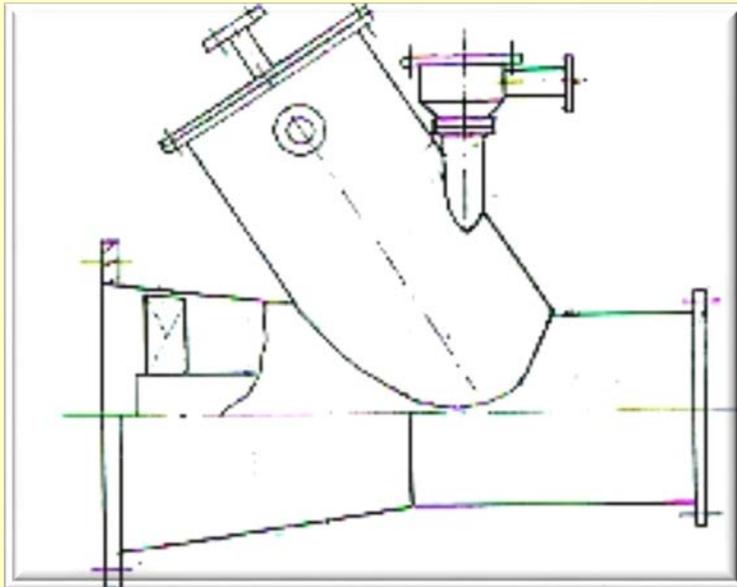
## **Efficiency:**

- ✓ increases the efficiency of fuel combustion;
- ✓ fuel economy is provided;
- ✓ the amount of NO<sub>x</sub> emissions is halved and CO emissions are more than five times.

# BURNER DEVICE

## for burning solid, liquid and gaseous fuels by thermochemical treatment method

The PPLG-8 burner device for burning  
Of a husk of buckwheat, oats, millet and  
natural gas.



### Basic technical characteristics

The main fuel is different types of solid	liquid and gaseous fuels
Additional fuel	liquid or gaseous
Additional fuel consumption	1 - 6% of the total fuel
Completeness of combustion	up to 1.0.

### Appointment:

Combustion of small-fractional solid fuel: various coals, industrial waste and processing of agricultural products, gaseous and liquid fuels - from light to fuel oil, water-fuel emulsions.

### Advantages:

The combustion of fuel takes place in the mode of spontaneous combustion, which is provided by its heating to the temperature of spontaneous combustion by high-temperature combustion products of additional fuel: liquid or gaseous.

### Efficiency:

In the products of natural gas combustion content: carbon monoxide - 0.0025 - 0.0075%; nitrogen oxides - 127 - 140 mg / m<sup>3</sup>.

The burner device can be manufactured for thermal capacity depending on the needs of the Customer, in accordance with the fuel.

**Patent SU** 1198322 A.

# PRESSED LAYER BURNER DEVICE



## **Appointment:**

For the combustion of coarse-grained solid alternative fuels: various brands of coal, waste from processing of agricultural products, woodworking industry and artificial fuel - pellets, briquettes. It can be used for the creation of boiler units and heat generators, as well as for the conversion of boilers of natural gas dryers, in order to replace it with alternative fuels.

## **Advantages:**

- ✓ two-stage process of fuel combustion;
- ✓ environmental friendliness;
- ✓ unpretentiousness to the type of fuel;
- ✓ small dimensions;
- ✓ simplicity of a design;
- ✓ low metal consumption and cost.

## **Efficiency:**

- ✓ increasing the efficiency of the boiler by 5-10%;
- ✓ complete replacement of natural gas.

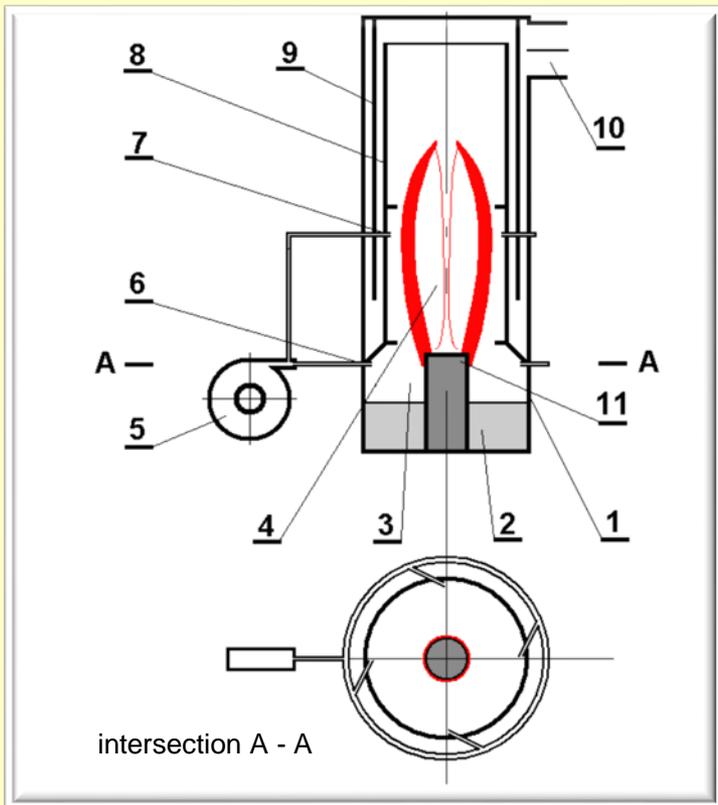
## **Basic technical characteristics**

The combustion process is	two-stage
Fuel: alternative fuels	coal, various wastes and pellets and briquettes
Completeness of combustion	up to 1.0
The thermal voltage of the combustion mirror is	from 3.0 MW / m <sup>2</sup> to 8.0 MW / m <sup>2</sup>

The burner device can be manufactured for heat capacity depending on the needs of the Customer, in accordance with the fuel.

The burner device is implemented in heat generators of drum dryers at the enterprise LLC "ORIY" (Ukraine, Berezan, 2013) and the company "LLC" VKP "Notes", (Ukraine, Sumy, 2015).

# HEAT GENERATOR WITH WICK BURNER



1 - housing; 2 - liquid fuel; 3 - combustion chamber; 4 - afterburner; 5 - fan; 6 - combustion chamber nozzles; 7 - afterburner nozzle chamber; 8 - 9 - screens; 10 - output pipe; 11 - wick.

**Patent of Ukraine:** 30701 A.

## **Appointment:**

The heat generator is designed for burning heavy liquid fuel, such as waste oil, substandard fuel, for heating hangars, garages, etc., as well as for cooking.

## **Advantages:**

The wick increases the residence time of the fuel in the zone of high temperatures, which allows the use of flammable fuels. In addition, it performs the functions of a filter. The process takes place without violating sanitary norms for CO and NOx.

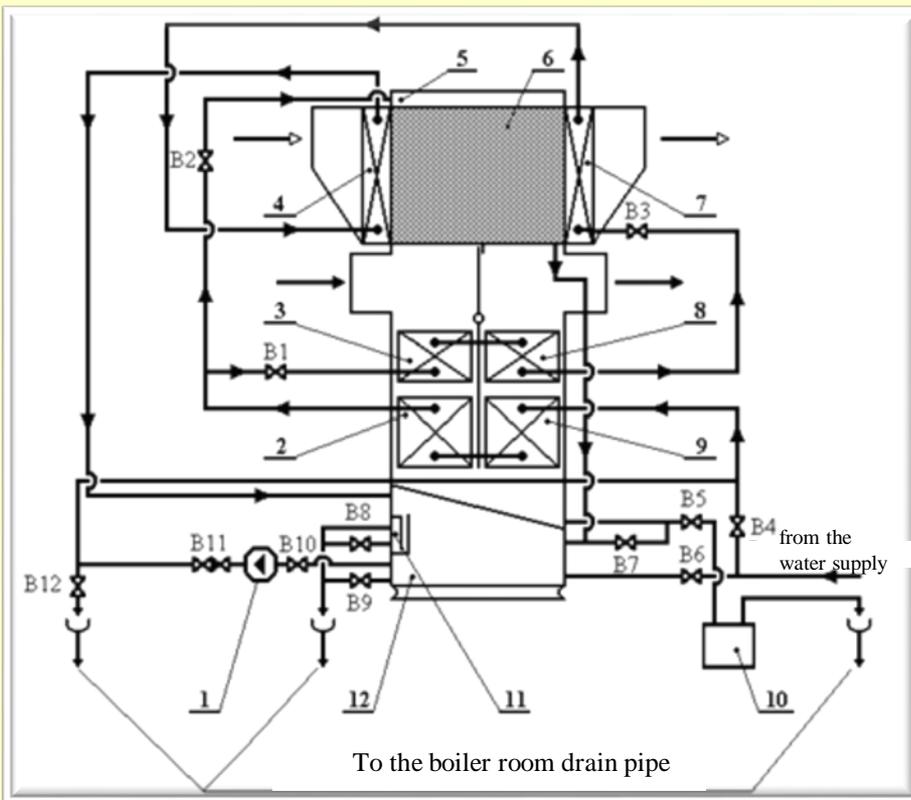
## **Efficiency:**

The use of substandard fuel for household needs reduces the likelihood of uncontrolled contamination of agricultural soils.

## **Basic technical characteristics**

Heat power, kW	10 - 40
Height, m	1,1
Housing diameter, m	0,5
Efficiency, %	82

# HEAT UTILIZATION EQUIPMENT FOR GAS-CONSUMING BOILER INSTALLATIONS : HEATER AND HUMIDIFIER AIR



1 - pump; 2,3,9 - water heater; 4 - air heater; 5 - water distributor; 6 - contact chamber; 7 - air superheater; 8 - gas heater; 10 - neutralizer; 12 - water catchment

**Patent of Ukraine:** № 56591.

## **Appointment:**

Heating and humidification of blast air due to the use of heat from the exhaust gases of boilers with a heat output of 0.63 MW.

## **Advantages:**

- ✓ autonomy from external heat consumers and heat suppliers;
- ✓ compactness;
- ✓ increasing the reliability of gas and air paths.

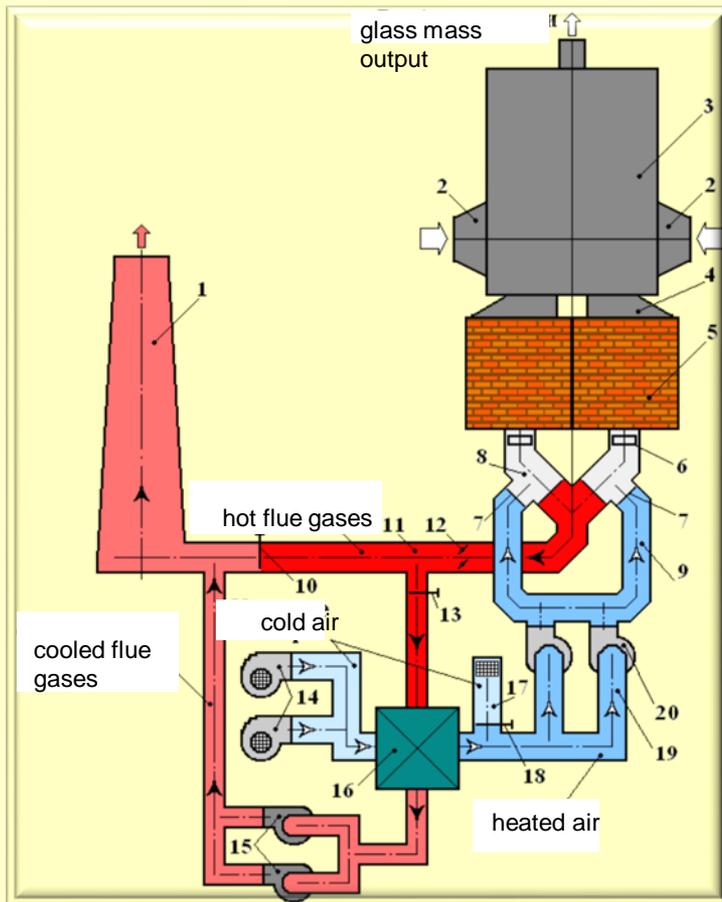
## **Efficiency:**

- ✓ increasing the heat utilization factor of KVTP fuel by 10-12%;
- ✓ ensuring the ecological effect: reduction of CO<sub>2</sub> by 10-12%, NO<sub>x</sub> up to 50%.

## **Basic technical characteristics**

Heat productivity, kW	80
Flue gas consumption, m <sup>3</sup> / h	1500
Air heating temperature, °C	60
Aerodynamic resistance on the gas side, Pa	500
Aerodynamic resistance on the air side, Pa	500

# HEAT UTILIZATION EQUIPMENT FOR GLASS FURNACES HEATER : FINAL RECUPERATOR



- 1 - chimney; 2 - boot pocket; 3 - cooking part of the oven; 4 - burner device;  
5 - regenerator; 6, 7, 10, 13, 18 - shibera; 8 - smoke channels; 9 - air channels;  
11 - exhaust path; 12 - rotary gates; 14, 20 - fans; 15 - smoke extractors,  
16 - recuperator, 17 - air intake from the atmosphere; 19 - air outlet from the recuperator

## **Appointment:**

Heating cold air before it enters the furnace regenerators by utilizing the heat of the exhaust gases.

## **Advantages:**

- ✓ compactness;
- ✓ ease of installation and operation;
- ✓ possibility of cleaning of working surfaces from dust deposits.

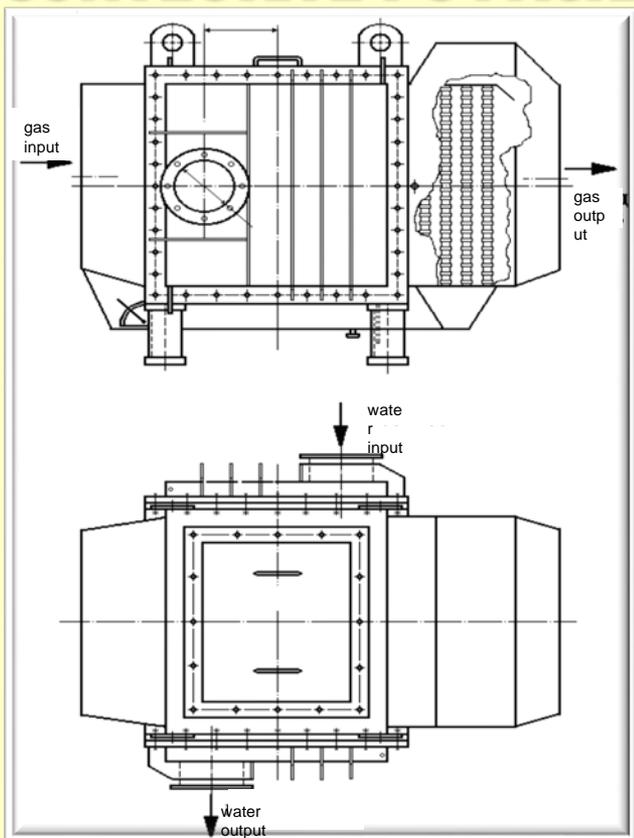
## **Efficiency:**

- ✓ increase the use of fuel heat in the furnace by 5-8%;
- ✓ reduction of harmful emissions into the environment by 5-8%.

## **Basic technical characteristics for different operating modes of the furnace**

<i>The name of the parameter</i>	<i>Value</i>		
Heat productivity, MW	1,7	1,6	1,5
The temperature of the gases at the input, °C	450		
The temperature of the gases at the output of the recuperator, °C	229	241	253
The temperature at the input, °C	-30	0	30
The temperature at the output, °C	151	170	190
The aerodynamic resistance on the gas side, Pa	460		
The aerodynamic resistance on the air side, Pa	440	470	510

# HEATING AND EQUIPMENT FOR GAS CONSUMPTION BOILER PLANTS: CONVECTIVE PC PACKAGES



## **Appointment:**

Heating of return water of the heat supply system due to the use of heat from the exhaust gases of boilers running on natural gas.

## **Efficiency:**

- ✓ increase of boiler efficiency by 4-6%;
- ✓ reduction of harmful emissions into the environment by 4-6%;
- ✓ payback period of capital expenditures up to 1.5 years.

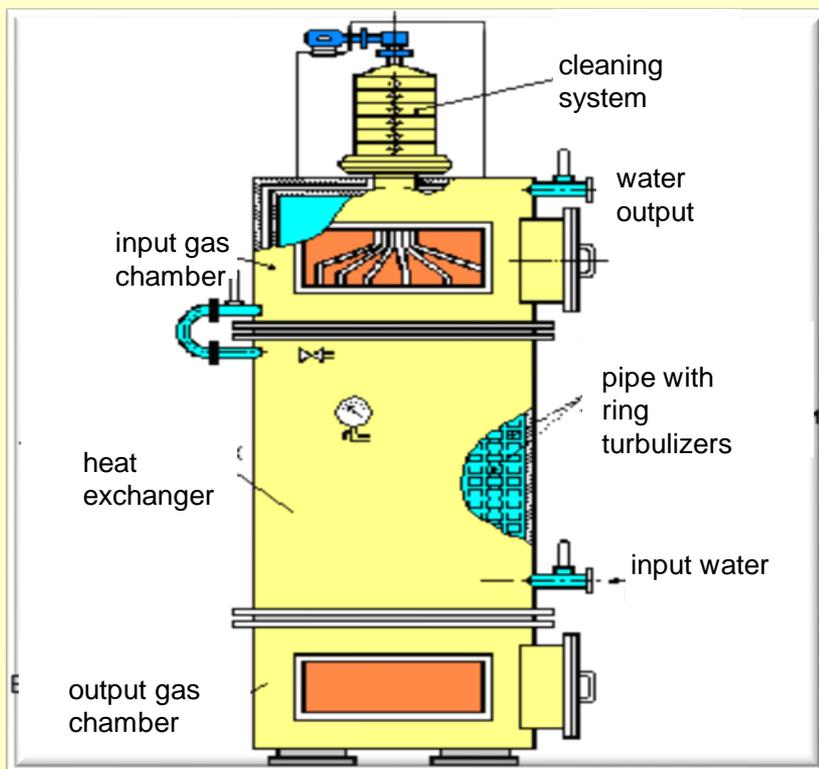
## **Basic technical characteristics**

<i>The name of the parameter</i>	<i>Value</i>
Heat productivity, kW	240-460
Flue gas consumption, m <sup>3</sup> / h	4300-13800
Water consumption, t / h	40-106
Aerodynamic resistance, Pa	65-240
Hydraulic resistance, kPa	1,5-3,2
Dimensions, mm:	
length	1442-2356
width	560-1240
height	700-1034
Weight, kg	672-1262

## **Advantages:**

- ✓ low hydraulic resistance;
- ✓ compactness and ease of installation;
- ✓ convenience in service;
- ✓ prevention of condensation in the exhaust tract.

# HEAT WASTE GAS UTILIZER IN INDUSTRIAL FURNACES



## Advantages:

- ✓ intensification of heat exchange due to the use of pipes with ring turbulizers, which allows to reduce the metal consumption and dimensions of heat exchange equipment by 1.5-2 times;
- ✓ automatic cleaning of working surfaces from deposits of technological dust.

## Appointment:

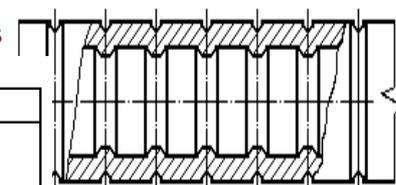
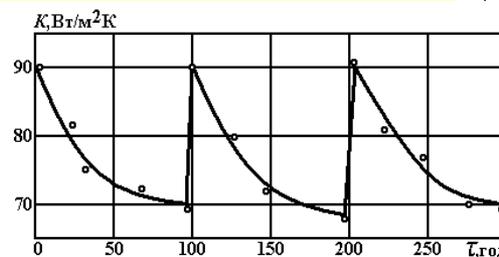
Heating water of heating systems by using the heat of clean and dusty exhaust gases of industrial furnaces for various purposes.

## Efficiency:

- ✓ natural gas savings by 10-20%;
- ✓ payback period of up to 1 year.

## Pipe with ring turbulizers

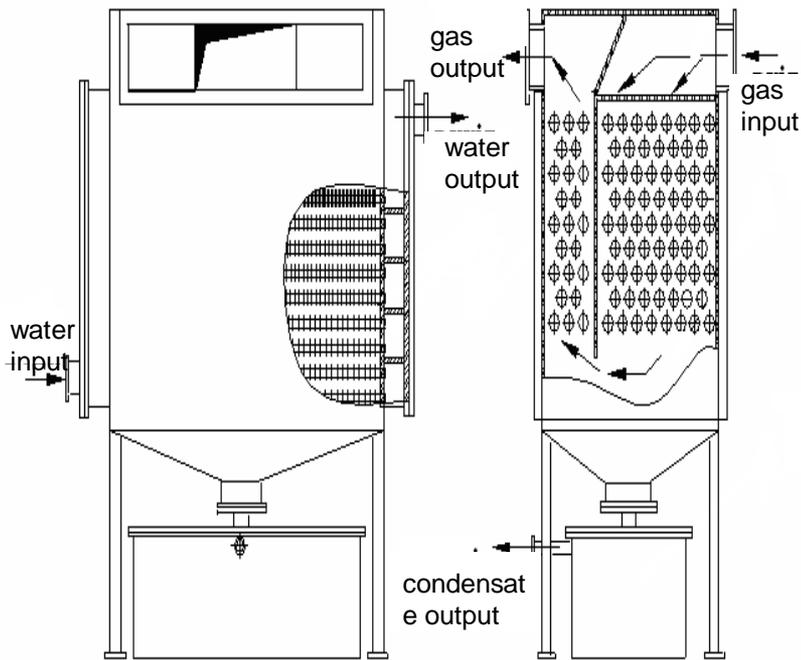
## Dynamics of heat transfer coefficient between purifications



## Basic technical characteristics

Heat productivity, MW	0,3-1,2
Temperature of water at the input, °C	70
Temperature of water at the output, °C	95
Temperature of the gases at the input, °C	450
Temperature of the gases at the output, °C	130-200
Flue gas consumption, kg / s	1,0-3,5
Aerodynamic resistance, Pa	450-600
Hydraulic resistance, kPa	5

# HEAT UTILIZERS SURFACE CONDENSATION



## Basic technical characteristics

Heat productivity of boiler, kW	3,15-0,25
Heat productivity of heat utilizers, kW	130-8
Temperature of the gases at the input, °C	240-160
Temperature of the gases at the output, °C	87-81
Temperature of water at the input, °C	70
Temperature of water at the output, °C	71,4-74,5

### Appointment:

Water heating of heating and hot water supply systems by using the heat of exhaust gases of gas-consuming boilers.

### Advantages:

- ✓ use of latent heat of condensation;
- ✓ insignificant dimensions and cost due to the use of ribbed bimetallic pipes;
- ✓ protection of exhaust ducts;
- ✓ ease of maintenance.

### Efficiency:

- ✓ increase of fuel heat utilization factor (KVPT) or boiler efficiency by 7-10%;
- ✓ reduction of harmful emissions by 7-10%;
- ✓ payback period of up to 2 years.

**Heat utilization installation with the heat utilizer behind the boiler DE-16-14GM**



# HEAT UTILIZERS MODULAR PANEL

## **Appointment:**

Heating of water of heating systems by use of heat of the dusted exhaust gases of industrial furnaces.

## **Advantages:**

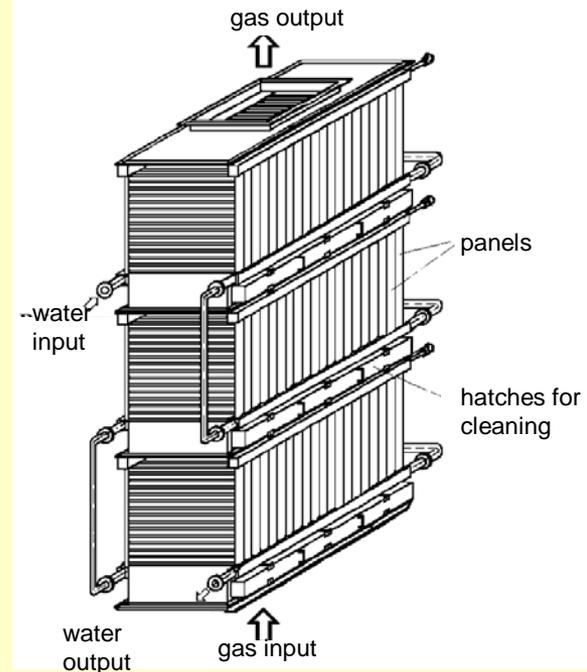
- ✓ the configuration of heat exchange surfaces (panels) helps to reduce dust deposits;
- ✓ possibility of cleaning of working surfaces from dust deposits.

## **Heat utilization installation behind a glass furnace**



## **Efficiency:**

- ✓ increase of fuel utilization factor (FUF) of the furnace by 10-30%;
- ✓ payback period of 3-6 months.



## **Basic technical characteristics**

Heat productivity, MW	0,15-3,5
Temperature of water at the input, °C	70
Temperature of water at the output, °C	95
Temperature of the gases at the input, °C	300-500
Temperature of the gases at the output, °C	150-250
Flue gas consumption, kg / s	1,0-3,5
Aerodynamic resistance, Pa	300-600
Hydraulic resistance, kPa	5-30

# EXHAUST GAS HEAT UTILIZERS BASED ON PIPES WITH INCOMPLETE TRANSVERSE RIBS FOR BOILERS PTVM-30M (40 MW), KVG-6.5 MW, KVG-4

## **Appointment:**

For using part of heat of exhaust gases during fuel combustion in furnace chamber of boilers for heating mains water.

## **Advantages:**

- ✓ reducing the cost of heat production;
- ✓ increasing the efficiency of the boiler;
- ✓ providing reduction of aerodynamic resistance on a smoke tract of a copper in 1,3... 1,5 times in comparison with heat utilizers from spirally finned pipes of round section.

## **Basic technical characteristics** (heat utilizer for PTVM-30 boiler)

Heat productivity, Gcal	1,2
heat carrier consumption through HU, m <sup>3</sup> / h	120
Heating surface area, m <sup>2</sup>	608
Working pressure of the heat carrier, MPa	0,8
Hydraulic resistance HU, kPa	8
Aerodynamic resistance HU, PA	360
Temperature of the exhaust gases at HU, ° C	127



## **Efficiency (heat utilizer for PTVM-30 boiler):**

- ✓ when using UT, the saving of natural gas is 158 m<sup>3</sup> / h;
- ✓ payback period is 5 months.

**Patents of Ukraine:** № 50491, 58212.

## **Introduced 2012-2014:**

Concern "Zaporozhye heating networks,"  
"Zhytomyrteplokomunenerho".

# SYSTEM OF CONTROL AND REGULATION OF UES LOADS OF UKRAINE USING HEAT PUMPS - HEAT LOSS UTILIZERS

## Appointment:

Utilization of low-temperature secondary thermal energy resources (VTER) of HPP using heat pumps to increase the supply of thermal energy and / or reduce fuel consumption - natural gas, depending on the inclusion schemes. Regulation of electric power of thermal power plants by means of heat pumps - utilizers of variable power (HPU), which allows to independently maintain the necessary thermal and electric power of thermal power plants in the economic mode of their combined production.

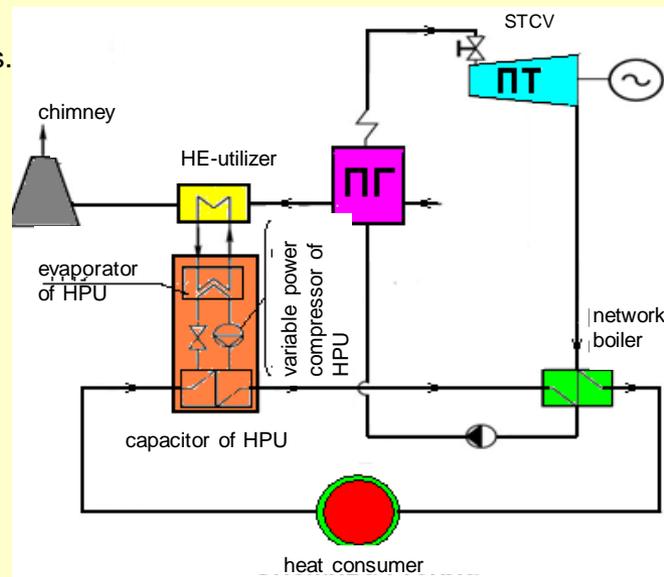
Saving of natural gas due to the support of HPP at the technological minimum of capacity with carrying an operational reserve, which can be realized during peak hours or in the event of an emergency power imbalance in the power system. At the same time, it is possible to instantly increase the capacity of the TPP by turning off the HPP.

Promoting a reduction in the systemic price of electricity due to its replacement by cheaper electricity from coal-fired power plants and nuclear power plants. It also improves the use of regulatory TPPs.

Involvement of VTER HPP for heat production, which allows to reduce its cost due to the high conversion factor of HPP - 4.5 - 5.5.

Improving the environmental condition in the service areas of CHP by reducing fuel consumption at HPP with HPU.

## Simplified scheme of HPU inclusion in the thermal scheme of HPP



**Patent of Ukraine:** № 104217.

## Efficiency:

Reduction of natural gas consumption when equipped with powerful HPP by HPU	up to 25% of the nominal cost
Range of regulation of electric loadings at operation of heat power plant in the economic district heating mode with the set heat power at interaction of HPU with turbines of HPP, on 1 MW of change of electric power of HPU	2,5-4,5 MW
The general range of regulation of electric power of HPP with HPU	35-60% of the nominal power of HPU
The general range of regulation of electric power of HPP of instant use (is realized by disconnection of heat pumps)	150 MW

# INSTALLATION FOR TREATMENT OF ACID AQUATIC SYSTEMS AND NEUTRALIZATION OF FLUE GAS CONDENSATE BY REAGENTLESS METHOD

## **Appointment:**

Treatment of water systems in food, medical, chemical industry, industrial and municipal energy, etc., as well as neutralization of flue gas condensate from gas boilers up to 10 MW equipped with a condensing economizer.

## **Application of installation will allow:**

- ✓ increase the value of the hydrogen index (pH);
- ✓ improve organoleptic characteristics;
- ✓ adjust physical and chemical properties;
- ✓ to carry out degassing of liquid;
- ✓ rational use of water resources through the reuse of neutralized condensate;
- ✓ reduce the amount of wastewater (condensate after chemical neutralization, waste water softeners).

## **Basic technical characteristics**

Productivity, l / h	to 450
pH of acidic condensate before neutralization, not lower	4,2
pH of neutralized condensate, not lower	6,0
Installed electric power, kW-h	3,75
Dimensions, mm	750x800x1100
Weight, kg	до 300



**Protected by patents of Ukraine  
for the invention UA 114374 and  
UA 115628.**

# HEAT PUMP HOT WATER SUPPLY SYSTEM WITH A POWER OF 1.44 MW IN KRAMATORSK

## **Appointment:**

Production of hot water using heat pumps that utilize the heat of untreated wastewater with a heat power of 1.44 MW.

## **Advantages:**

- ✓ low cost of hot water production;
- ✓ quick payback;
- ✓ high energy conversion factor;
- ✓ use of renewable energy source
- ✓ no emissions of greenhouse gases and pollutants into the atmosphere.

## **Efficiency:**

Annual replacement of fossil natural gas in the amount of 1.47 million m<sup>3</sup>.



## **Basic technical characteristics**

Low potential heat source and its consumption G, m <sup>3</sup> / h	Untreated wastewater G = 120
Connected load of hot water supply system Q, gcal / h	1,24
Number of hot water consumers, pers.	4401
Average conversion factor	3,6

# AUTONOMOUS HEAT PUMP HEATERS

## Appointment:

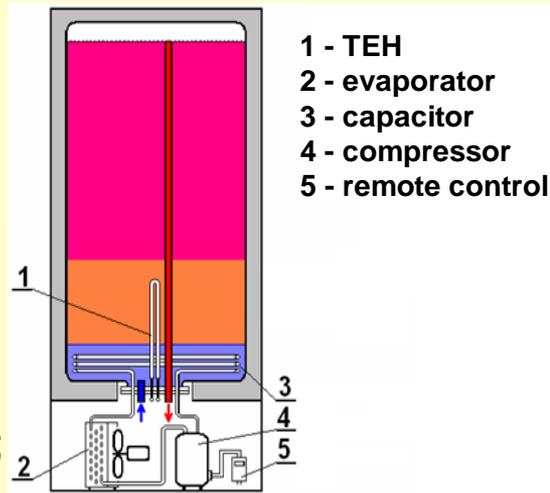
Production of hot water due to the use of air-to-water heat pumps that utilize low-potential ambient heat.

## Advantages:

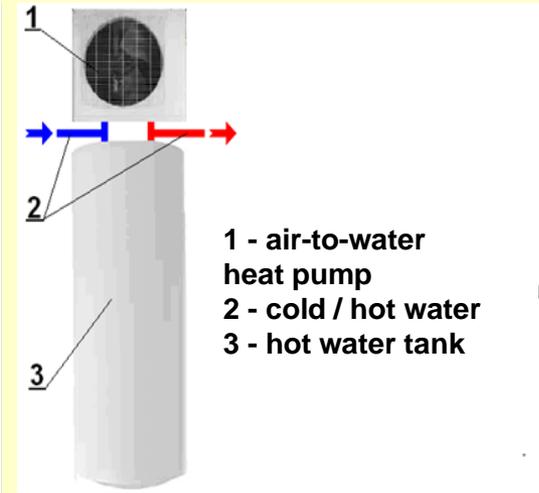
- ✓ low cost of hot water production;
- ✓ quick payback;
- ✓ high energy conversion factor;
- ✓ low cost of water heaters in comparison with foreign analogues;
- ✓ use of renewable energy source.

## Efficiency:

Reduction of the power consumption for 80 l in 2,7 - 3,6 times, for 200 l in 2,6 - 4,2 times in comparison with electric water heaters.



**Scheme of a heat pump water heater with a capacity of 80 l with a built-in heat pump**

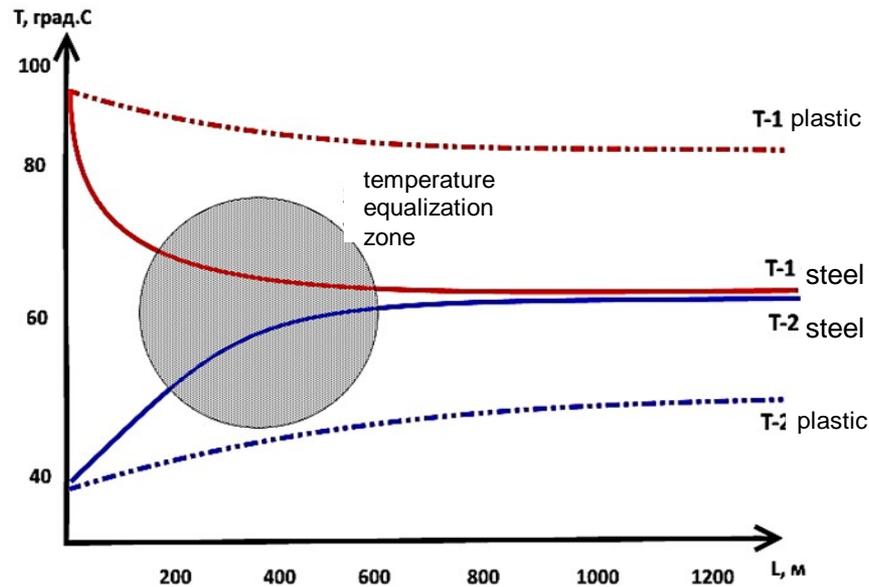
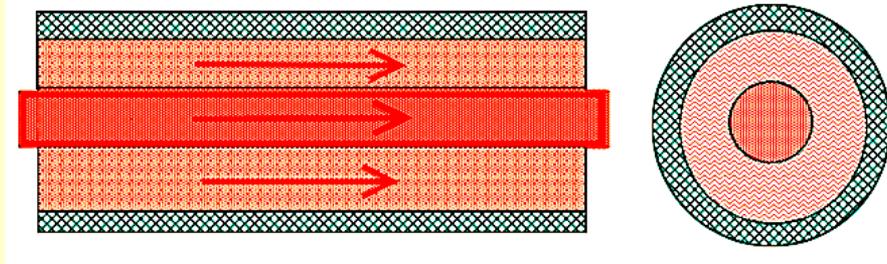


**Scheme of a heat pump water heater with a volume of 200 l with a separate heat pump unit**

## Basic technical characteristics

Boiler volume, l	80	200
Hot water temperature, °C	40 - 55	40 - 55
Installed power, kW	0,25	0,8
Electricity consumption for water heating, kWh • h	0,7 – 1,47	1,37 – 3,51
Conversion factor	2,89 – 3,57	2,75 – 4,24

# HEAT NETWORK WITH COAXIALLY LOCATED PIPELINES



**Patents of Ukraine:** № 105366.

## **Appointment:**

For transportation of the heat carrier from a source of thermal energy to the consumer by pipelines of a new design of distributive and main thermal networks.

## **Advantages:**

- ✓ no loss of heat energy into the environment from the supply pipeline;
- ✓ protection against mechanical and temperature deformations and failure of the supply pipeline is provided.

## **Efficiency:**

- ✓ fuel consumption for heating the coolant in the boiler room is reduced;
- ✓ qualitative indicators of the heat carrier at giving to the consumer are provided;
- ✓ material costs are reduced during the underground laying of the heating network route.

## **Basic technical characteristics**

The figure shows the nature of the temperature distribution of the coolant along the length of the pipe depending on the diameter of the pipeline.

# NEW TUBULAR HEAT EXCHANGE SURFACES

## **Appointment:**

Heat exchangers of various types, in particular regenerators of gas turbine engines, gas turbines for aero engines.

## **Advantages:**

In cross flow of tubes bundle with surface dimples heat transfer enhancement is 1.3...1.7 as large along with the hydraulic losses decrease by 20% downstream offset of the separation zone. Heat transfer enhancement is 1.3 as large in the moderate increase hydraulic losses (1.7 as large).

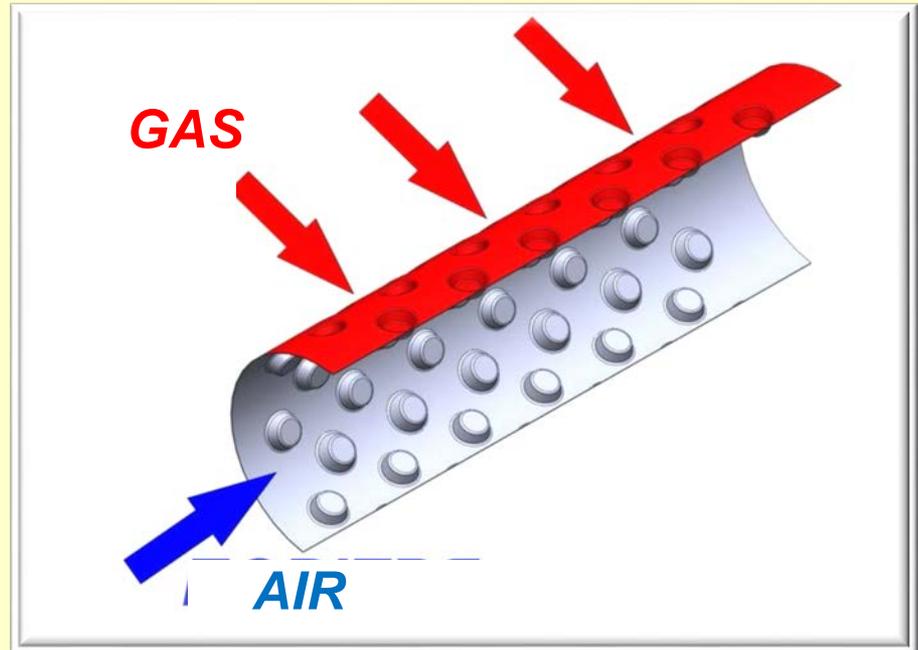
## **Basic technical characteristics**

<b>Environment parameters:</b>	
<b>temperature, °C</b>	<b>20 – 500</b>
<b>gas flow rate, m / s</b>	<b>&lt;15</b>

**Patent of Ukraine:** № 30701 A.

**Implemented at**

SE NVGK 'Zorya' – "Mashproekt".



## **Efficiency:**

The annual gas savings from the modernization of one HPP with a capacity of 16 MW with a new engine is 20,000 thousand m<sup>3</sup>, which can almost be compared with the estimated cost of the proposed GTP.

The mass of the regenerator with the proposed types of heat exchange surfaces is 20% less than the mass of the regenerator with smooth pipes.

# NEW HEAT EXCHANGE SURFACES

## **Appointment:**

Creation of heat exchange equipment for heat recovery of exhaust gases of thermal power plants and other applications.

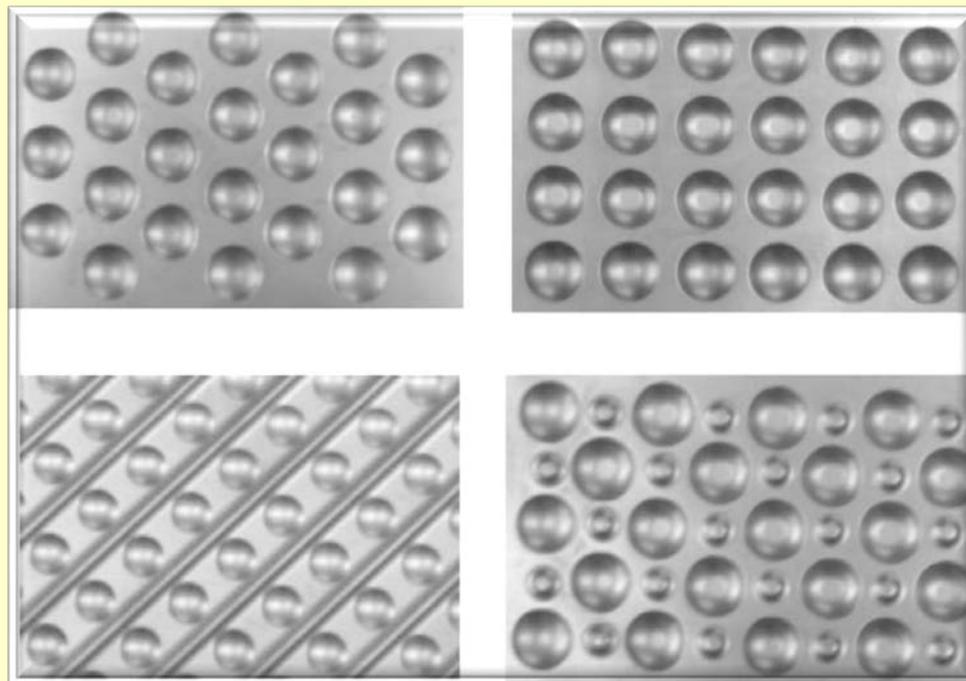
## **Advantages:**

The use of new heat exchange surfaces provides higher heat transfer efficiency, lower hydraulic costs, small size and material consumption, high compactness of heat exchange equipment.

## **Efficiency:**

- ✓ heat transfer efficiency up to 95%,
- ✓ relative hydraulic flow rates  $\Delta P / P < 5\%$ .

**Patent of Ukraine:** № 78360.



## **Basic technical characteristics**

The level of heat exchange intensification, $Nu/Nu_0$	3...5
Thermohydraulic characteristics, $(Nu/Nu_0)/(f/f_0)$	0,5...2
Material of heat exchange plates	foil with a thickness of 0.1... 0.2 mm
Plate manufacturing technology	cold stamping

# NEW GENERATION SHELL & TUBE HEAT EXCHANGERS

Thin-wall flexible corrugated stainless tubes with discrete vortex generators are used as the heat exchange elements.

**Heat exchanger ТКГ-350**



**Heat exchanger ТО-75**



## ***Advantages:***

- ✓ heat transfer coefficient higher than 1.3-1.5 times;
- ✓ lower metal content;
- ✓ lower production costs;
- ✓ reduction of scale deposits and salts due to the self-cleaning effect.

# STAND FOR INVESTIGATION OF HEAT TRANSFER DURING THE MOVEMENT OF TWO-PHASE FLOWS IN THE PIPES OF AIR COOLING CONDENSERS

## **Appointment:**

For research of energy saving schemes of condensation of water vapor in condensers of air cooling (CAC) and for creation of their new designs.

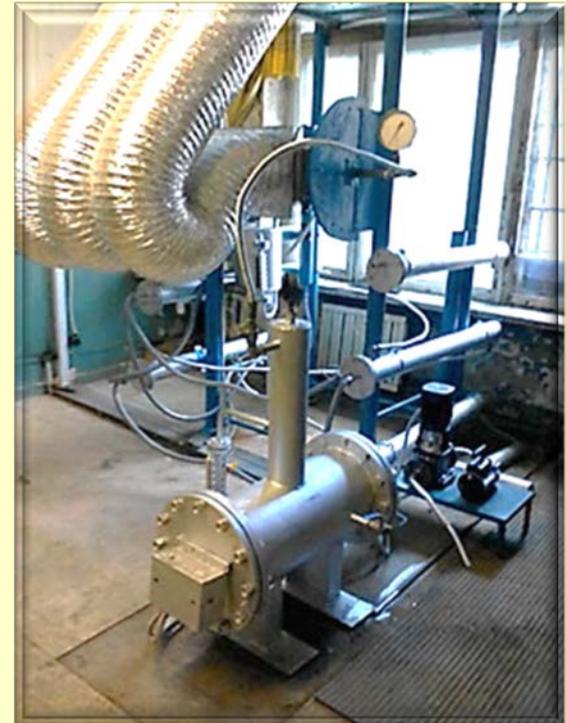
## **Efficiency:**

- ✓ low energy costs during research;
- ✓ the possibility of creating new and modernizing existing CAC, cooling towers with a closed cooling cycle;
- ✓ heat exchangers for heating / cooling air of supply ventilation systems.

## **Basic technical characteristics**

Working pressure of steam-water mix, MPa	0,6
Maximum steam temperature, °C	160
Steam productivity, kg / h	28,8
Air consumption, no more, m <sup>3</sup> / h	7000
Cooling water consumption, not more, m <sup>3</sup> / h	0,5
Installed electric power of the stand, no more, kW	22

**Patents of Ukraine:** № 78367, 97712.



## **Advantages:**

- ✓ the possibility of studying the efficiency of new designs of air-cooled condensers;
- ✓ ease of adjustment at various operating modes.

# HEAT CONSUMPTION CONTROL SYSTEM WITH SOLAR COLLECTORS AND HEAT ACCUMULATOR



## **Appointment:**

Works as an individual heating point in residential, administrative and industrial buildings.

## **Advantages:**

- ✓ optimization of the heat exchange process, thermal modes and control algorithms due to the original electronic controller;
- ✓ automatic weather-dependent regulation of coolant temperature in heating systems;
- ✓ correction of the schedule depending on the time of day and day of the week;
- ✓ protection of the internal heat supply system from excess external pressure.



## **Basic technical characteristics**

Heat power, Gcal	0,3...1,0
Heat carrier temperature control range, °C	30...90
Maintaining the set temperature in the room	automatically

## **Efficiency:**

- ✓ heat carrier savings 20... 35%;
- ✓ works in heating systems with one-pipe and two-pipe distribution;
- ✓ payback period 2-4 heating seasons.

**Patents of Ukraine:** № 72168.

# LOW-APERT MAGNETOSTRICTOR SENSORS FOR HEATING AND HEATING EQUIPMENT MONITORING SYSTEMS



## **Efficiency:**

- ✓ extension of the service life of heating equipment by 1.5-2 times;
- ✓ reduction of costs for equipment repairs by 2-2.5 times;
- ✓ reduction of expenses for elimination of emergency situations in 3-5 times.

**Patents of Ukraine:** № 104567, № 105611, № 107629.

## **Appointment:**

Radiation and reception of ultrasonic signals in objects of complex shape at  $T \leq 600^{\circ}\text{C}$ .

## **Advantages:**

- ✓ radiation and reception of longitudinal, surface, transverse and other types of ultrasonic waves;
- ✓ acoustic contact with the object without the use of contact fluids;
- ✓ Curie point:  $600-1200^{\circ}\text{C}$ ;
- ✓ small area of the radiating surface, which allows to increase the resolution of the sensors by an order of magnitude compared to piezoelectric sensors;
- ✓ relatively low cost.

## **Basic technical characteristics**

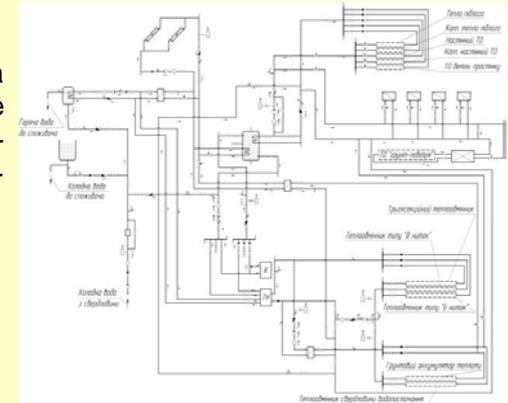
Frequency range, MHz	0,5...5,0
Contact surface area, mm <sup>2</sup>	0,07...0,8
The duration of the pulse sensing, ms	0,4...32
Double conversion factor	0,008...0,02
Electrical impedance, Ohm	0,1...30
Orientation diagram:	
for surface waves	circular
for longitudinal waves	spherical

# THE COMBINED HEAT PUMP AIR-CONDITIONING SYSTEM OF THE EXPERIMENTAL PASSIVE HOUSE OF "0-ENERGY" TYPE



The specific heat losses of the building (total area of 306 m<sup>2</sup>) are 14.3 kWh-hours/(m<sup>2</sup> year) when the calculated value of the minimum outdoor temperature during the heating season is -22°C and internal indoor air temperature is 20°C.

The value of thermal power systems:	
heating	2,6 kW;
hot water supply	3,4 kW
supply and exhaust ventilation (with air heating)	5.7 kW



Schematic hydraulic diagram of the combined heating system of the pilot passive building of "0-energy" type

The source for the heat pump (capacity 6.2 kW) is low-grade heat ground array around the building, which is removed using ground-liquid heat exchangers (mounted from polyethylene pipes of multiloop or U-like forms heat exchangers in 8 groundwater wells of a depth 25 m and 40 m or 3 horizontal and register collectors at a depth of 2.2 m) in combination with heating devices as warm water floors (including capillary) of different stacking geometry and heat exchangers in the spaces between rooms, and liquid-air heat exchangers (wall and floor) for heating and air conditioning in rooms (fan coil units). In the warm season the system provides for seasonal heat accumulation (including passive air conditioning in the rooms), followed by its use in the cold season. Provides compulsory supply and exhaust ventilation with heat recovery with auxiliary heating of air after the heat exchanger into the house, and heating incoming outside air due to its previous passing through ground-air heat exchangers. As a backup heating system provides radiator system based on universal solid fuel boilers, as well as emergency heating system provides passive-convection air heating system. Some rooms also provide electrical cable and thermomembrane underfloor and wall heating. The auxiliary heat sources are: seasonal use tanks heat accumulators, including a heat carrier contains paraffin); operation of solid fuel fireplace with a water lave its surface; organization of thermal curtain of building facades by air that passes through the pre-ground heat accumulators; industrial water intake for technical and household needs from a well depth of 38.5 m in the area of the house. The main heating systems are automated.



# THE SYSTEM OF ELECTRIC POWER SUPPLY FOR PASSIVE HOUSE OF "0 ENERGY" TYPE

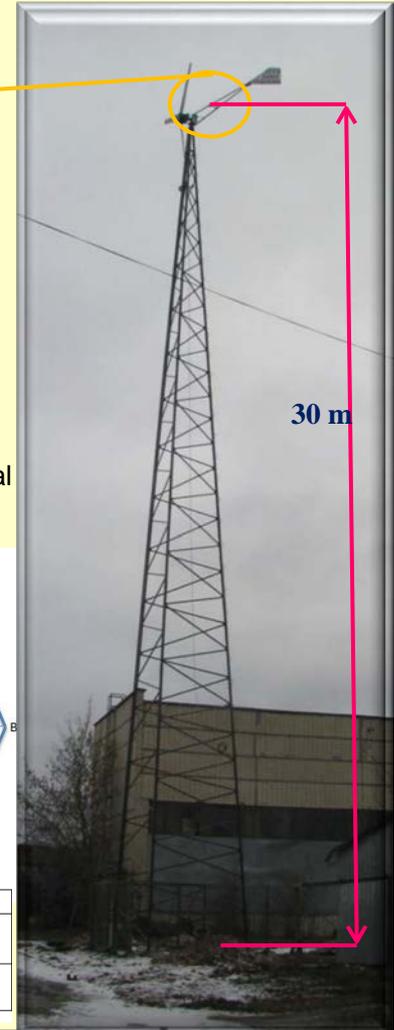
The system of electric power supply of the passive house "0 energy" is based on the use of renewable energy sources: solar energy and wind. Key elements of the system - Fortis Montana wind turbine, rated power of 5 kW; 22 monocrystalline photovoltaic panels QSolar QS- 240W, total power of 5.3 kW and 60 polycrystalline panels Calyxo CX3 80W, total power of 4.8 kW. The total rated power of the system is 10 kW, output power not less than 600 kWh/(month).

The block diagram of the electric power supply of the passive house of "0 energy" type



Design scheme

For determination of wind potential near passive house of "0 energy" type was conducted mathematical modeling.



30 m

Schematic diagram of electric power supply of the passive house "0 energy"

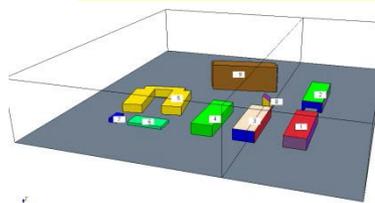
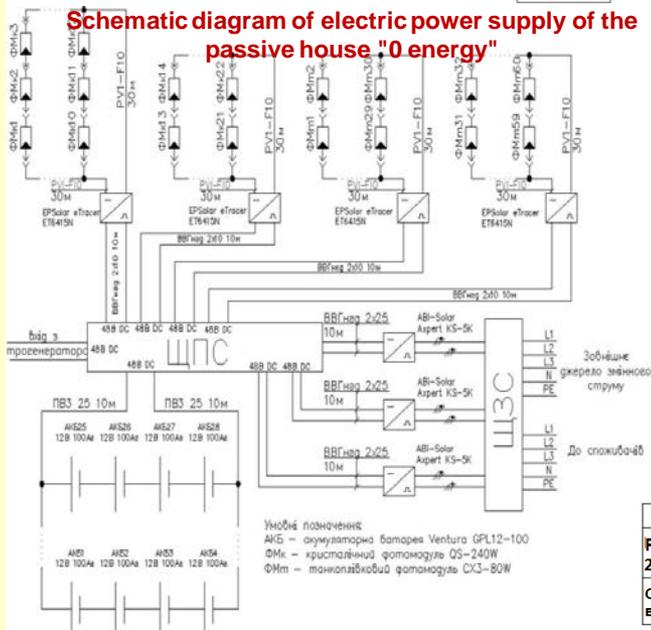
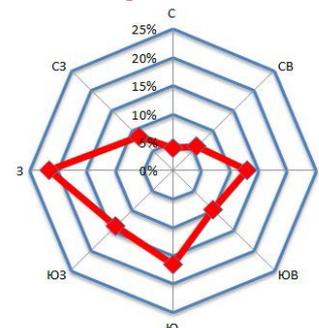


Photo from above



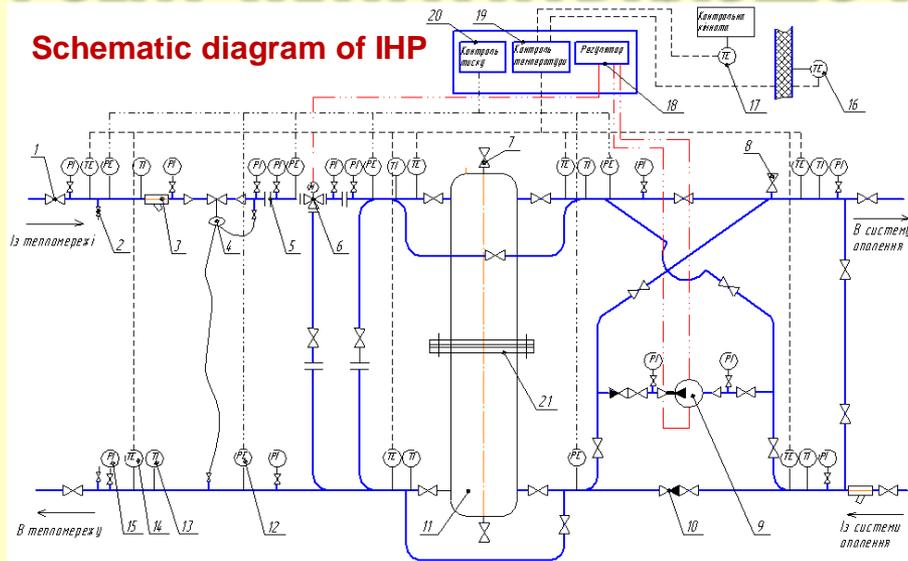
A diagram of wind



Румб	С	СВ	В	ЮВ	Ю	ЮЗ	З	СЗ
Роза вітрів ОП 2007 - 2008	4%	6%	13%	10%	17%	14%	21%	8%
Середня швидкість вітру	3,4	3,9	3,4	3,0	3,4	3,2	5,0	4,7

# THE INDIVIDUAL HEAT POINT WITH A HYDRAULIC ARROW

**Schematic diagram of IHP**



**Legend:** 1 – a ball valve; 2 – a drain valve; 3 - a filter sediment; 4 – a differential pressure regulator; 5 - a washer; 6 – a three-way valve; 7 – a venting valve; 8 – a safety-valve fault; 9 – a circulation pump; 10 – a return valve; 11 – a hydraulic arrow; 12 – a pressure sensor; 13 – a thermometer; 14 – a temperature sensor; 15 – a pressure gauge; 16 – an outdoor temperature sensor; 17 – a temperature sensor in the room; 18 - a regulator; 19- a temperature control; 20 – a control pressure; 21 – a check valve.

**The real average cost savings of heat energy for the heating period is up to 15%.**

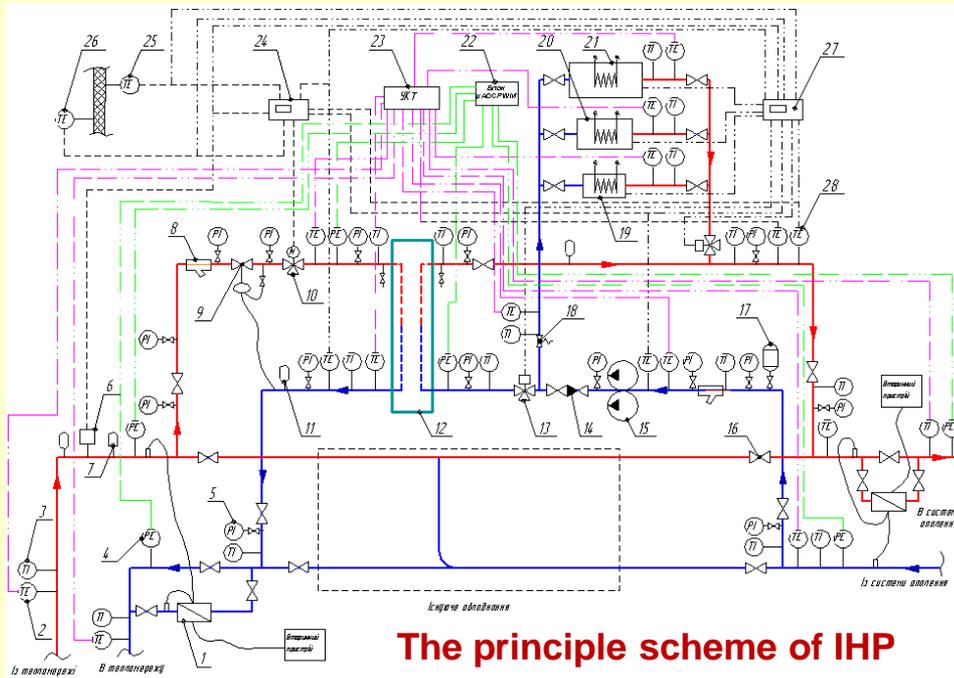
Feature of the development of IET of NAS of Ukraine from *typical* IHP is combined in one IHP three heat meters, three-way (two-way) valves, hydraulic arrow, hydraulic mixing unit for membrane that allows to implement various variants of the hydraulic circuit IHP and its effective modes of operation.

**Pat. 70590 Ukraine, 6IPC**

(2012.01), F24D 15/00, F24D 3/02 (2006.01). Individual heating unit / applicant and the owner is the In-t of Engineering Thermophysics of NAS of Ukraine. - № U 201109780; appl. 08.08.2011; publ. 25.06.2012, Bull. № 12.-3 p.



# THE INDIVIDUAL HEAT POINT WITH ELECTRIC BOILERS



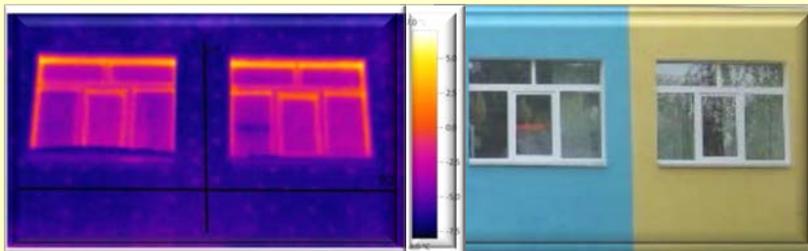
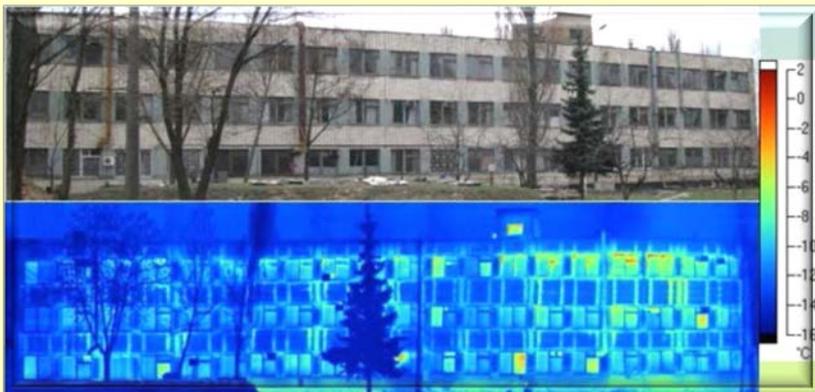
**Legend:** 1 – a heat meter; 2 – a temperature sensors; 3 – a thermometer; 4 – a pressure sensor; 5 – a pressure gauge; 6 – a sensor of dry run; 7 – a pressure switch; 8 – a mesh filter; 9 – a regulator of pressure drop AVP; 10 – a 2-way regulating valve; 11 – a safety air valve; 12 – a plate heat exchanger; 13 – a stop-valve 2-way Drive; 14 – a return valve; 15 – a pump; 16 – a shut-off valve; 17 – an expansion tank; 18 – a safety valve; 19 – an electro heater "Eco"; 20 – an electric heater "Pioneer"; 21 – an electric boiler "Titan"; 22 - block ADCPWM; 23 - UCT; 24 – an electronic controller ECL-300 with the card management C66; 25 – a room temperature sensor ESM 10; 26 – an outdoor temperature sensor ESMT; 27 – an electronic controller ECL-300 with card management C75; 28- temperature sensor ESMU.

**The patent for useful model № 38541** Ukraine. Individual heating point for heating and hot water systems./ Publ.12.01.2009, Bull. №1.

**The special difference of the development of IET of NAS of Ukraine from a typical IHP:** is the presence of electric boilers of various capacities, which allows not only regulate, but also independently of the heat distribution networks to generate heat, for example, during a night failure of electricity.



# POLYGON OF DIFFERENTIAL HIGHLY EFFICIENT THERMOMODERNIZATION OF WALL STRUCTURES



## ***Appointment:***

For research of heat losses and thermophysical characteristics of modern thermal insulation materials used in the system of bonded thermal insulation with reinforced plaster layer in terms of their real operation.

## ***Advantages:***

The conducted researches give the chance to establish an optimum variant of warming of a wall design in system of warming with the reinforced plaster layer. The installation allows to obtain experimental data on the thermal conductivity of different variants of thermal insulation coatings in terms of their long-term operation depending on the temperature and humidity of the outside and inside of the building. Using the results of research, it is possible to establish the effectiveness of a particular insulation (expanded polystyrene 15, 25, 35 kg / m<sup>3</sup>; extruded expanded polystyrene; foamed glass basalt wool of high density) (including the use of environmentally friendly binder bentonite clay-periculite)) in the system of bonded insulation depending on changes in external and internal conditions.

## ***Efficiency:***

The development allows to obtain a bank of experimental data on the thermal characteristics of enclosing structures with their various thermal renovation (walls, windows, panel joints, etc.) in real conditions of long-term operation.

# MODULAR INSTALLATION FOR THE PRODUCTION OF STAPLE BASALT SUPERTHIN FIBER



## **Appointment:**

Two-stage production of special and construction staple heat-sound-insulating basalt superthin fiber.

## **Basic technical characteristics**

<b>Final product:</b>	special and construction heat-sound-insulating staple basalt fibers (1-3 microns);
<b>Productivity:</b>	up to 200 tons/year (25 kg/h).
<b>Energy consumption:</b> natural gas (up to 10 kPa) electricity (380 V, 50 Hz)	up to 420 thousand m <sup>3</sup> /year; up to 460 thousand kWh/year
<b>Resource consumption:</b> basalt raw materials compressed air (Rnadl. = 0,3 ati) technical circulating water (Rnadl. = 1 ati)	up to 230 tons/year; up to 720 m <sup>3</sup> /year;  up to 12 m <sup>3</sup> /year.

**Development stage:** research and industrial installation, controlled operation.

## **Innovative components and advantages of development**

### **(in comparison with domestic and foreign analogues):**

- ✓ energy - reduced consumption of natural gas and electricity in 1.5 times (due to the use of: specialized bath basalt smelting regenerative type; an upgraded feeder with a plate spin feeder, which is heated by electric current; systems of forced cooling of the furnace body; automated control, management and security system; inflating chambers with gas-cooled porous burner device);
- ✓ technological - improved the quality of finished products (due to improving the physicochemical properties of the basalt melt and reducing the number of non-fibrous inclusions);
- ✓ operational - high maneuverability of the installation, which allows to flexibly respond to market needs (due to small - compared to multi-station - the size of the installation and the use of ordinary refractory materials).

**2, Bulakhovsky str., Kyiv, Ukraine, tel.: (044) 424-32-85, 424-15-86, e-mail: kremnev@ukr.net**

# MODULAR INSTALLATION FOR THE PRODUCTION OF BASALT CONTINUOUS COMPLEX THREAD



## Basic technical characteristics

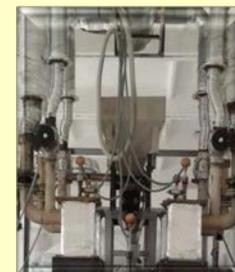
Thickness of filaments	≤ 12 microns.
Productivity	up to 80 tons / year (10 kg / h).
Energy consumption: natural gas (up to 10 kPa) electricity (380 V, 50 Hz)	up to 45 000 m <sup>3</sup> / year; up to 215 000 kWh / year
Resource consumption: basalt raw materials compressed air (Rnadl. = 10ati) water (Rnadl. = 1 ati)	up to 100 tons / year; 0.27 m <sup>3</sup> /minute; 3.5 m <sup>3</sup> /year

## Appointment:

Production of basalt direct roving, which is formed by a combination of an ensemble of 200, 400 elementary threads.

## Innovative components and advantages of development (in comparison with domestic and foreign analogues):

- ✓ energy - reduced by 2.0 times the specific consumption of natural gas (due to the use of a new specialized bath basalt smelting regenerative type);
- ✓ technological - improved mechanical performance of direct roving (textile quality), due to the small diameters of the filaments (achieved by a two-stage scheme of supply of melt to the die using platinum jet and spin feeders);
- ✓ operational - high maneuverability of installation that allows to respond flexibly to market needs (it is caused by the small - in comparison with multipost – sizes installation and use of ordinary refractory materials).



## Development stage:

experimental industrial installation, controlled operation.



# MODERNIZED CONTINUOUS TECHNOLOGICAL LINE FOR THE PRODUCTION OF BASALT CARDBOARD

## **Appointment:**

Production of basalt heat-insulating cardboard from staple basalt superfine fiber (BSTV) and binder based on bentonite clay. The line is intended for equipping shops of production of rigid and semi-rigid heat-sound-insulating flat products.

## **Innovative components:**

- ✓ increasing the external heat and mass transfer coefficients with the surface of the material by increasing the circulation of the drying agent and the speed of washing the surface.
- ✓ intensification of drying agent preparation by complete reconstruction of burner system.

## **Technical and economic advantages**

(in comparison with domestic analogues):

- ✓ increased productivity by 25-35%;
- ✓ reduced specific energy costs by 15%.

## **Development stage:**

experimental industrial installation, controlled operation.

### **Basic technical characteristics**

Final product	flat basalt-bentonite heat-insulating products 5,10,15 mm thick
Raw	canvas from staple BSTV $\varnothing 1 \div 3$ microns, bentonite clay, water
Productivity	21-23 m <sup>3</sup> / day.
Heat power	2 MW
Installed electric power	110 kW
Energy carriers	natural gas (up to 50 kPa), electricity (380 V, 50 Hz)



# MODERNIZED TUNNEL DRYING INSTALLATION OF DISCRETE-CONTINUOUS ACTION

## Appointment:

Production of soft / hard thermal insulation boards made of staple basalt superfine fiber (BSTV) and binder based on bentonite clay. The installation is intended for equipment of shops of production of heat-insulating plates.

## Technical and economic advantages (in comparison with domestic analogues):

- ✓ increased productivity of the drying unit by 1.3 times (from 7 to 9 m<sup>3</sup> / day);
- ✓ reduced specific consumption of natural gas by 1.7 times (from 250 to 150 st. m<sup>3</sup>/ m<sup>3</sup> of plates). Savings - 900 cubic meters / day;
- ✓ reduced nedopal (CO≤130 mg / m<sup>3</sup>);
- ✓ GHG emissions were reduced by ~ 740 t / year.

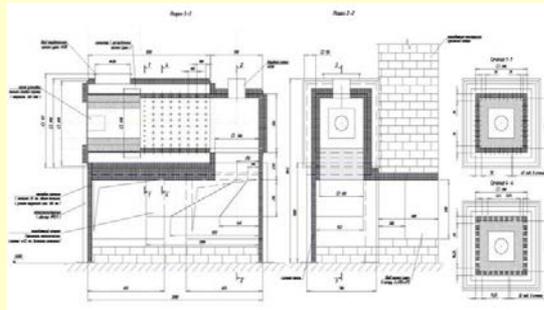
## Innovative components:

By way of:

- ✓ the thermal level of the process is increased;
- ✓ increased the speed of the drying agent and the frequency of its circulation;
- ✓ implemented discrete-continuous loading / unloading of material and its "step-by-step" movement in the chamber.

By devices:

- ✓ created and applied new unified heat generators with a design capacity of 320 kW; which provide controlled preparation of the drying agent - a mixture of combustion products and spent drying agent in a wide range of thermal loads without compromising the quality of natural gas combustion;
- ✓ developed and created a drying chamber in which the directional movement of the drying agent through the carts with the material, with multiple circulation of the drying agent; increased the thermal resistance of the enclosing structures of the chamber by 1.7 times.



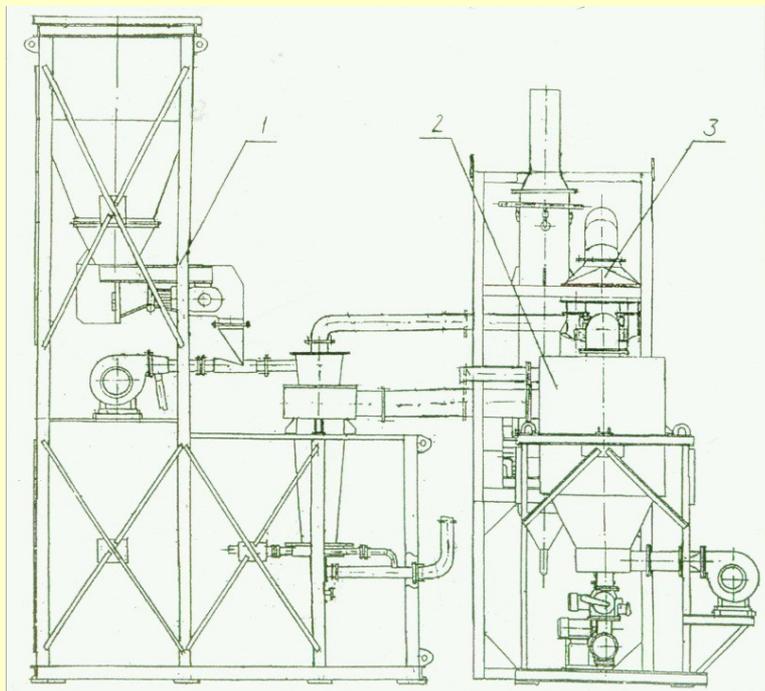
## Basic technical characteristics

Final product	soft / hard heat-insulating plates 30 - 100 mm thick.
Raw	staple BSTV Ø1 ÷ 3 microns, bentonite clay, water.
Productivity on finished products	up to 9 m <sup>3</sup> / day
Heat power	0,96 MW
Installed electric power	30 kW
Energy carriers	natural gas (up to 50 kPa); electricity 380 V, 50 Hz.

## Development stage:

experimental industrial installation, controlled operation.

# MOBILE INSTALLATION FOR THE PRODUCTION OF EXPANDED PERLITE SAND MU - 5



## **Efficiency:**

- ✓ environmental friendliness;
- ✓ reduction of electricity consumption by 50%;
- ✓ reduction of heat consumption for thermal preparation of raw materials by 15-20%.

**Patent of Ukraine:** № 50884.

## **Appointment:**

Production of expanded perlite sand with the set qualitative indicators on the advanced technology which includes preliminary preparation of narrowly fractionated perlite raw materials and its swelling.

## **Advantages:**

- ✓ ability to work on two types of fuel - gaseous and liquid;
- ✓ low cost;
- ✓ possibility of production of expanded perlite sand directly on the place of its consumption;
- ✓ easy to adjust and maintain.

## **Basic technical characteristics**

<b>Productivity</b>	<b>5 m<sup>3</sup> expanded sand</b>
<b>Dimensions of the unit:</b>	
length	7380 mm
width	5094 mm
height	6190 mm
<b>Weight total installation</b>	<b>5731 kg</b>
<b>Fuel:</b>	
natural gas (consumption)	50,585 mm / hour
fuel oil M100 (diesel fuel: consumption)	40 kg / h
<b>Specific heat consumption</b>	<b>1148 kcal / kg</b>
<b>Power of electric motors</b>	<b>15 kW</b>

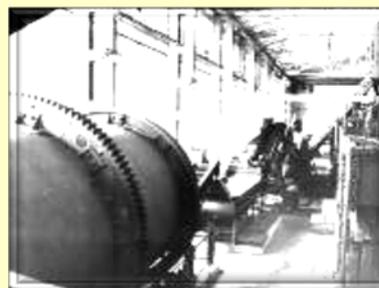
# THE TECHNOLOGICAL LINES WITH TUNNEL AND CONVEYOR DRYERS

Scope - agro-industrial enterprises for obtaining dried products and powders.

**Productivity** on raw material 10...1000 kg/h. Possible heating sources of the heat are carrier with the help of pair, liquid fuel, natural gas or biomass.



**Tunnel dryers**



**Conveyor dryers**



## **Advantages:**

- ✓ year-round operation of drying units;
- ✓ versatility in terms of objects of processing - from vegetables and fruits to aromatic raw materials, including medicinal herbs;
- ✓ low heat consumption per 1 kg of evaporated moisture - 3400... 3800 kJ;
- ✓ reduction of emissions into the environment.

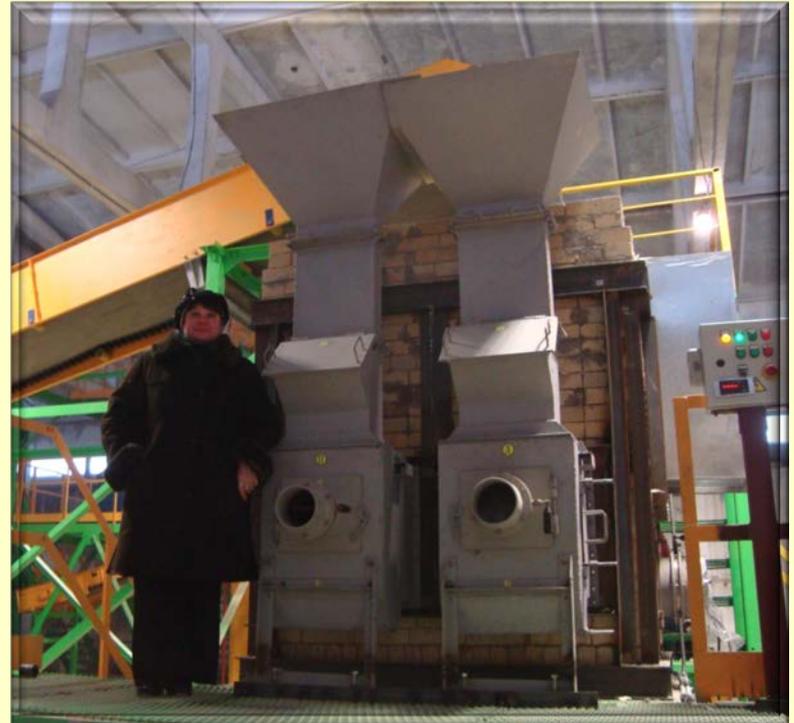
The design of drying units is protected: a.c.- № 1079015, 1151049, 1763829;  
**patents of Ukraine** -15238, 12357, 22196, 29597, 43174, 47561, 56833, 57514, 109083.

# THE HEAT GENERATORS ON FUEL OF VEGETABLE ORIGIN

The heat generators on fuel of vegetable origin with capacity of 0.7 MW, was established in subsection TMC. The heat generator runs on vegetable fuel - chips and granules and is able to use large lump fuel - wood and others. The heat generator made of three blocks: post-combustion and mixing (fireplace) and two primary furnace heat output of 350 kW each.

The primary furnace, due to the peculiarities of their work, including in its composition: bunker for small fraction of fuel - wood chips and granules ( pellets), small storage fractional fuel, feeder large lump fuel and burning devices of restrained over the layer.

The heat generator embedded in the process of drying mineral fertilizers drum dryer as the source of the drying agent, the company LLC "Oriy" (Ukraine. Berezan, 2013).



# MOBILE SMALL INSTALLATIONS FOR THE MANUFACTURE OF MLF AND MEDICINES TYPE KMP2 AND TYPE "CREAM-PHARM"

## **Appointment:**

Production of soft combined medicines (ointments, gels, liniments, etc.) on hydrophilic and hydrophobic bases at the pharmaceutical enterprises.

## **Advantages:**

KMP2 and Creoma-Pharm type installations are made with the possibility of working in autonomous mode, the possibility of carrying out a set of technological operations: thermostating, heating/cooling of the system, dispersion, emulsification, homogenization, structuring, mixing and others.

The creation of a research and industrial plant such as "Creoma-Pharm" has solved one of the scientific problems associated with the creation of complex processing methods that allow to obtain the necessary nanostructure of drugs with predictable properties, which include sorption drugs.



## **Basic technical characteristics**

Productivity, kg / h	up to 200
Reactor volume, dm <sup>3</sup>	160
Installed electric power (maximum), kW	16
Material of working surfaces	Steel 316
Overall dimensions, mm:	
length	1500
width	700
height	1600
Weight, kg	320

**Patents of Ukraine:** № 20698, № 49029, № 36711.



# THE DRUM DRYER FOR DRY FERTILIZERS

The drum dryer for dry fertilizers was introduced by the company LLC "Oriy" (Ukraine, Berezan, 2013). The subsection TMC Institute of Engineering Thermophysics NAS of Ukraine fulfilled the calculation process of drying mineral fertilizers in the dryer drum, defined thermal power sources and the technical characteristics of the drying agent and established the flow sheet drying process.

According to the flow sheet, the chosen equipment - drum drying system and removal of the drying agent - was made overall layout equipped. As a source of the drying agent, a heat generator that runs on wood fuel was used.

Performance of the dryer for raw materials (pellets from sunflower husk ash) - 5000 kg / h. Raw materials - granules from sunflower husk ash. Heat consumption specific - 5547,318 kJ / kg.



# HEAT PUMP DRYERS



## **Appointment:**

Heat pump dryer is designed for low-temperature convective drying of thermolabile materials of plant and animal origin: fruits, vegetables, herbs, etc.

## **Advantages:**

- ✓ high quality of the received product;
- ✓ controlled heat and humidity drying conditions;
- ✓ ecological purity of the technological process, no greenhouse gas emissions into the environment;
- ✓ reliability, ease of operation and long service life;
- ✓ consumes only electricity;
- ✓ does not require a specially equipped room.

**Patents of Ukraine:** № 76063, 85875.

## **Efficiency:**

Due to the utilization of the heat of the spent coolant, the amount of specific energy consumption to remove moisture from the material is 1.5-2 times lower compared to traditional convective dryers.

## **Basic technical characteristics**

Drying temperature	40 - 55 °C
Amount of water evaporated from product	up to 2 kg/h
Amount of product dried	up to 40 kg/day
Installed electrical power	1,0 kW
Electrical energy consumption for evaporation	0,3...0,7 kWh/kg
Net weight	80 kg
Dimensions, mm	900x650x1850



# PLANT FOR PRODUCTION LIQUID FEED AND WORT

## **Appointment:**

Processing of starch-containing media in order to obtain dispersions with a certain degree of dispersion. As raw materials are used: Cereal crops, granules, solid and liquid additives, water or distillery slops.

## **Advantages:**

- ✓ several technological operations (dispersion, mixing, dissolution, heating, hydrolysis are carried out in one device);
- ✓ the ability to adjust the particle size of the final product;
- ✓ reducing the duration of processing.

## **Efficiency:**

- ✓ reduction of processing time by 25-30%;
- ✓ reduction of electricity consumption by 10-12%;
- ✓ preservation of product nutrients.

**Patents of Ukraine:** № 80151, 110074.



## **Basic technical characteristics**

<b>Productivity</b>	<b>500 kg / hour</b>
<b>Energy consumption</b>	<b>3 kWh/100 kg</b>
<b>Weight</b>	<b>60 kg</b>
<b>Dimensions</b>	<b>200X1500X700 mm</b>

# HEAT AND MASS TRANSFER FERMENTATION PLANT

## **Appointment:**

To obtain gas-saturated liquids, even with gases that are difficult to dissolve (oxygen, carbon dioxide).  
Use in the technology of cultivation of aerobic microorganisms and in the water treatment to eliminate undesirable impurities (iron, manganese, hydrogen sulfide).

## **Advantages:**

- ✓ creation of the expanded interphase surface "gas - liquid";
- ✓ increasing the rate of mass transfer of oxygen to the culture medium;
- ✓ compactness.

## **Basic technical characteristics**

Productivity	7 m <sup>3</sup> / hour
Product productivity	30 - 40 kg per day
Energy consumption per 1 ton	180 kWh
Weight	15 kg
Dimensions	500X250X350 mm

**Patents of Ukraine:** № 102394, № 102081, № 102393.



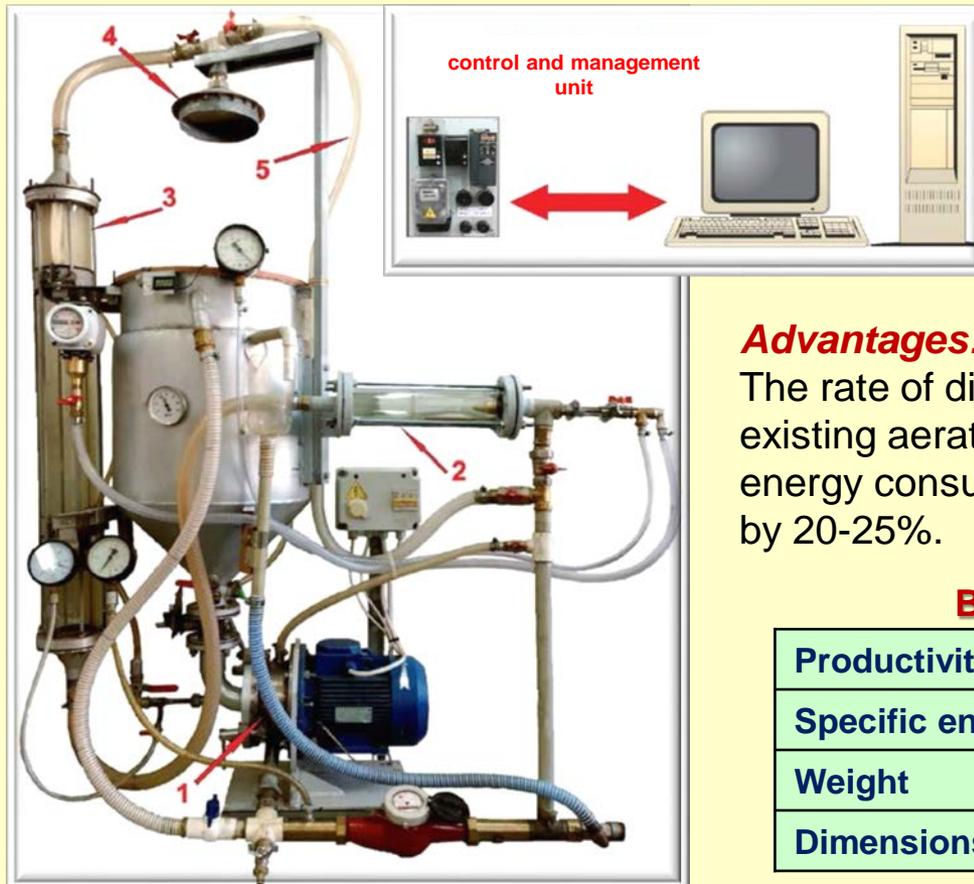
## **Efficiency:**

- ✓ reduction of cultivation duration by 3 times;
- ✓ increase in the maximum concentration of yeast in 1,5 - 2 times.

# ROTARY TYPE AERATION AND OXIDATION INSTALLATION (AORT)

## Appointment:

The unit is used for enrichment of water with oxygen, purification of drinking water from iron, manganese, hydrogen sulfide and carbon dioxide in accordance with DSANPiN 2.2.4-171-10-10 "Hygienic requirements for drinking water intended for human consumption".



- 1 - aerator-oxidizer; 2 - ejector unit;
- 3 - filtration column; 4 - spray head;
- 5 - recirculation circuit.

## Advantages:

The rate of dissolution of oxygen in comparison with existing aeration devices increases by 3-4 times, energy consumption is reduced by 30-35%, the cost by 20-25%.

## Basic technical characteristics

Productivity	5.0-8.0 m <sup>3</sup> / year
Specific energy consumption	0.2 kW · year / m <sup>3</sup>
Weight	30,0 kg
Dimensions	1000X1500X500

# EQUIPMENT FOR PREPARATION OF VARIOUS EXTRACTS FROM VEGETABLE RAW MATERIALS

## **Appointment:**

Obtaining extracts from any type of vegetable raw materials, which opens up opportunities for widespread use in the food, alcoholic beverages, medical industry, cosmetology, agriculture, etc.

## **Advantages:**

- ✓ maximum yield of target components;
- ✓ significant intensification of dispersion, homogenization and mixing processes.

## **Efficiency:**

- ✓ the mode parameters of the process of extraction of humic substances from peat of the lowland type depending on the required productivity with the possibility of further application in the agro-industrial complex have been worked out;
- ✓ experimental batches of concentrated product from flax seeds, which is included in the bread recipe;
- ✓ developed a composition of the drink based on flax seeds, which is protected by a patent.

## **Basic technical characteristics**

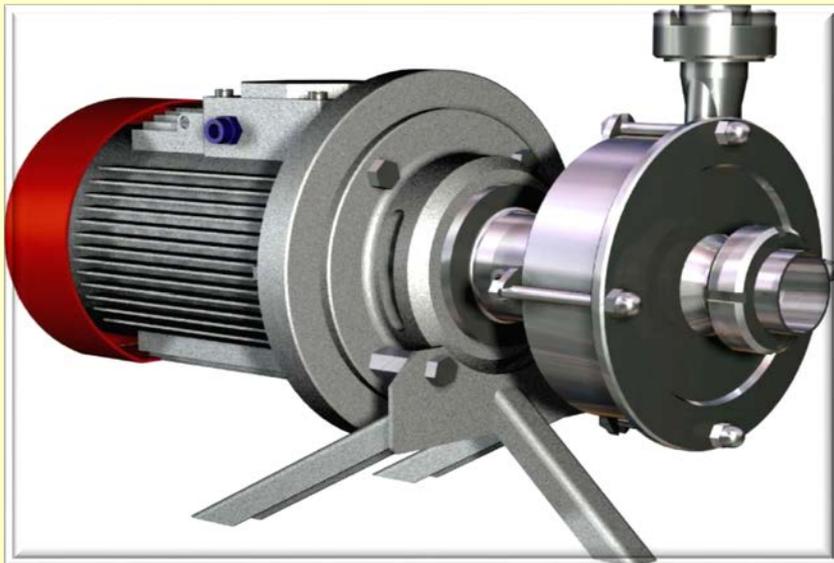
Installation productivity, kg / hour	10-30
Energy consumption per 1 kg of dry extract, kW · h / kg	50-300
Dimensions, mm	1000x1200x1500



## **Patents:**

Pat. Of Ukraine 87728, IPC A23S23 / 00. Drink based on flax seeds.

# HOMOGENIZER- DISPERSANT AR-3000



The low energy consumption of homogenizers-dispersants is due to the fact that the treated medium is both a source and an object of hydromechanical oscillations, ie in such devices there are no intermediate energy transformers, mechanical energy is directly converted into acoustic and cavitation energy, due to this efficiency.

**Patent of Ukraine:** № 20698A.

## **Appointment:**

Homogenization and dispersion of suspensions and emulsions in food, pharmaceutical, dairy, perfumery and cosmetics and other industries.

## **Advantages:**

Intensification of chemical-technological processes in these devices is due to the multifactorial effect on the treated medium, which consists in pulsations of pressure and flow velocity, developed turbulence, intense cavitation and collapse of cavitation bubbles, high shear forces, etc.

## **Basic technical characteristics**

Productivity, kg / hour	up to 3000
Dispersion, microns emulsions suspensions	2...5 25...50
Installed electric power, kW	2
Rotor speed, rpm	2880
Material of working surfaces	12X18H10T
Overall dimensions, mm	600*350*26 5
Weight, kg	5

# MOBILE UNIT TYPE "FARMATRON"

## **Advantages:**

Constructively made with the possibility of connection to the technological equipment operating at the pharmaceutical enterprises. Provides energy saving, resource saving, high-quality homogenization of the product, improved quality of drugs, improved working conditions, reducing the duration of the production cycle.

With the help of this unit, the production of stable suppository preparations on diphilic bases was established at OJSC Monpharm (Monastyrshche).



**Patents of Ukraine:** № 59460, № 55709.

## **Appointment:**

Dispersion of drugs directly at the base.

## **Basic technical characteristics**

Productivity, kg / h	up to 1000
Dispersion, microns emulsions suspension	2...5 25...90
Installed electric power (maximum), kW	4,5
Power of dispersant-homogenizer, kW	3,0
Power of the food pump, kW	1,5
Material of working surfaces	Steel 316 or 321
Overall dimensions, mm: length width height	1300 600 1400
Maca, кг	100

# INSTALLATION FOR THE PRODUCTION OF OINTMENTS AND GEL



## **Advantages:**

The proposed technological scheme and design of the installation allowed to obtain fine (up to 60-90 micron) homogeneous pharmaceuticals in the form of ointments, creams, pastes, gels, etc. soft dosage forms that meet the requirements of pharmaceutical articles, expand the range of products, reduce the duration processes of dispersion, homogenization, to exclude a number of auxiliary technological operations.

## **Appointment:**

Production of soft combined medicines (ointments, gels, liniments, etc.) on hydrophilic and hydrophobic bases at the pharmaceutical enterprises.

## **Basic technical characteristics**

Productivity, kg / h	up to 400
Number of reactor, units.	2
Reactor volume, dm <sup>3</sup>	160
Installed electric power (maximum), kW	30
Mixer drive power, kW	2,2
The power of the dispersant-homogenizer, kW	3,0
Power of the food pump, kW	1,5
Power of electric heaters, kW	9
Material of working surfaces	Steel 316
Overall dimensions, mm:	
Length	2300
Width	1310
Height	2220
Weight, kg	980

**Patents of Ukraine:** № 20698, № 49029, № 36711.

**Implementation:** CJSC "Borshchahiv Chemical Plant" (Kyiv).

# THERMOBAT-M INSTALLATION

## **Appointment:**

Preparation of the basics of production of soft dosage forms and providing heating and melting of vaseline, paraffin, lanolin, solid fats, etc. directly in the metal barrels of the manufacturer, as well as the supply of melt to the reactor for further processing.

## **Basic technical characteristics**

Type of product by melting method	immersion
Installed electric power, kW	12
Productivity on vaseline, kg / change	400
The heat carrier	water / propylene glycol
Temperature control range, °C	20-120
Surface material	304L
Surface material, in contact with the product	316L
Number of circulating pumps, pcs.	1
Number of product pumps, pcs.	1
Overall dimensions, mm:	
length	1095
width	1560
height	2720
Weight, kg	420

**Implementation:** KP "Pharmacy" "Lugansk Pharmaceutical Factory" (Lugansk), JSC "Riga Pharmaceutical Factory" (Riga), LLC "Ternopharm" (Ternopil).

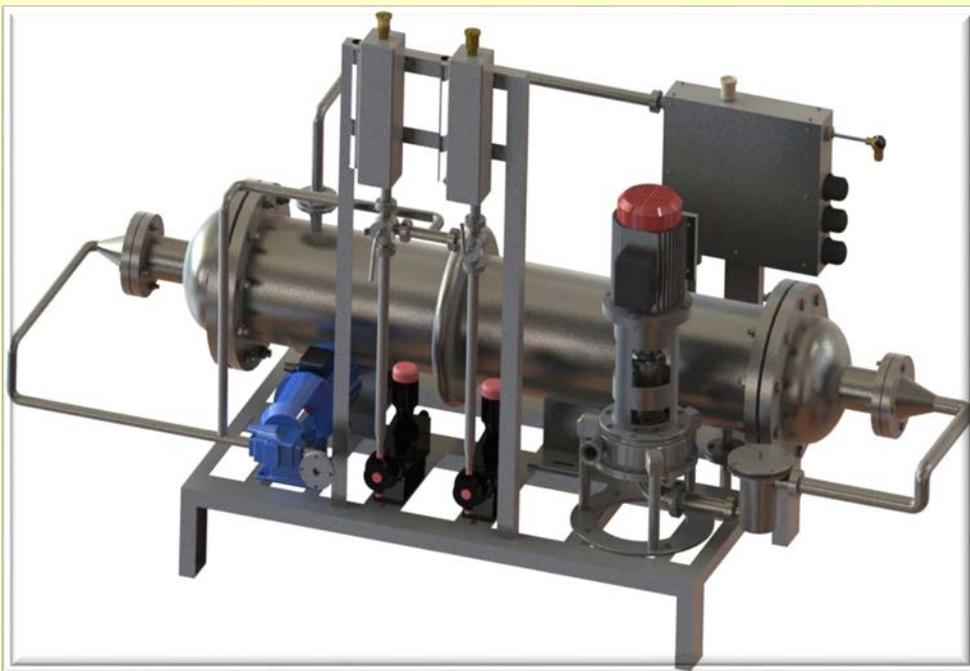


## **Advantages:**

Installation allows to carry out effectively processes of heating and melting of pharmaceutical bases to reduce time of carrying out melting process, provides pumping of the molten substance of regulation of temperature of the heat carrier, automatic support of the set temperature of the heat carrier to 120 °C (propylene glycol), 95 °C (water) and digital indication of the set and reached temperatures.

**Patents of Ukraine:** № 31435, № 69860, № 77487.

# STATION OF PREPARATION OF BIOFUEL MIXTURES SPBS-1000



## Basic technical characteristics

Installed electric power, kW	up to 21
Productivity, kg / h	no less 1000
Type of heat exchanger	casing-pipe
Coolant temperature, °C	95
The dispersion of the emulsion, microns	2...10
Nominal voltage, V	380
Weight, kg	650

## **Appointment:**

Obtaining a mixture of traditional motor fuels with biocomponents (biodiesel or bioethanol) or with other impurities designed to improve the performance of the source fuels.

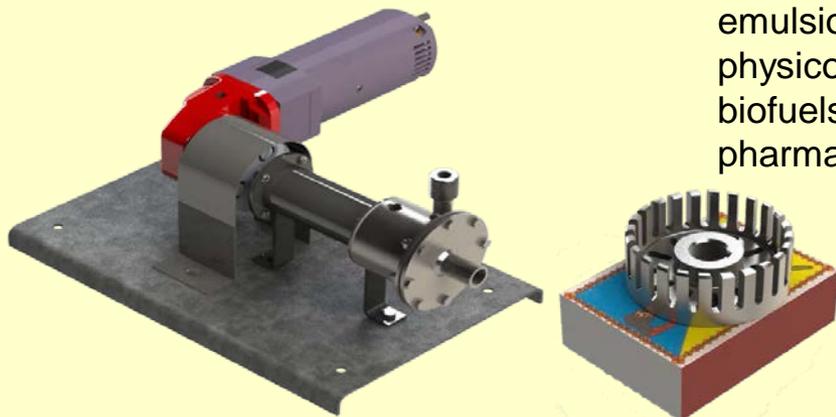
## **Advantages:**

- ✓ provides homogenization of "liquid-liquid" systems with the formation of fine emulsions or solutions;
- ✓ provides mixing of components due to injection (absorption) of liquids and gases in system "liquid-liquid";
- ✓ provides heating and cooling of "liquid-liquid" systems to the set temperature.

**Patents of Ukraine:** № 47397, № 76807.

**Implementation:** design documentation for Il-Prom LLC and PJSC SPE "Bolshevik" with the subsequent possibility of launching scientific and technical products into serial production.

# ROTOR-PULSATION DEVICE LDCD-750



## Advantages:

Geometric parameters were chosen based on rational experiments certain values of the frequencies of overlap of the slots of the rotors and stators, shear rates in the gaps between the stators and rotors to ensure intensive hydrodynamic treatment of the reaction mixture.

## Appointment:

Homogenization and dispersion of suspensions and emulsions, as well as for the intensification of physicochemical processes in the manufacture of liquid biofuels. The device can also be used in the pharmaceutical, chemical and food industries.

## Basic technical characteristics

Productivity *, kg / h	~50
Particle size: * emulsions, microns suspension, microns	2...5 25...50
Electric power, kW	0,75
The frequency of shaft rotation, rev / min	3000...10000
Rated current, A	8,2
The diameter of the pipe: suction, mm discharge, mm	15 10
The pressure on the suction line, MPa	0,15 – 0,25
Overall dimensions, mm: length width height	380 360 220
Material of working surfaces	12X18H10T
Weight, kg	8

\* the parameter depends on physicochemical properties of substances, their concentration, viscosity, necessary degree of dispersion and pressure on the soaking-up side

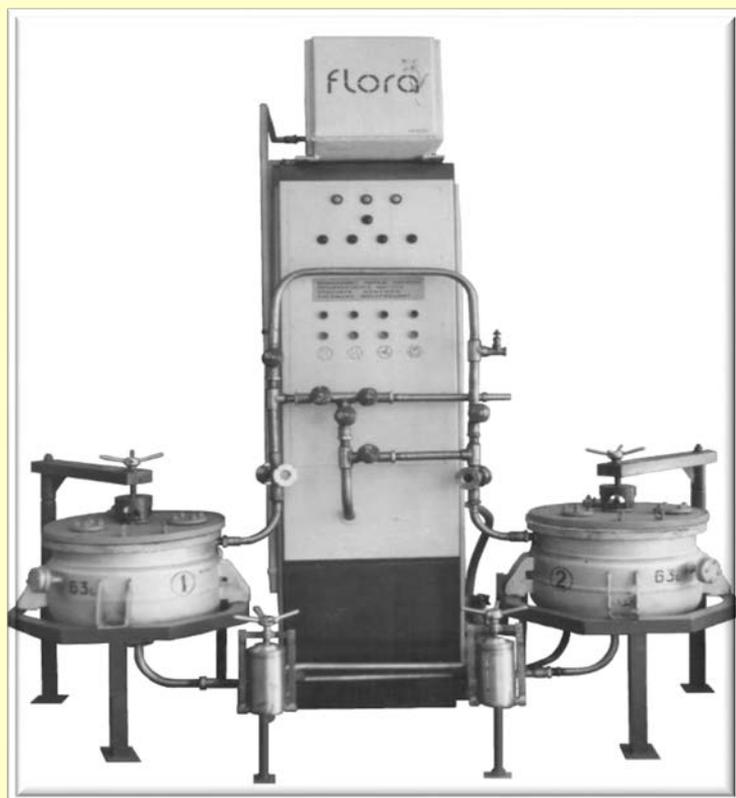
# INSTALLATION "FLORA"

## **Appointment:**

Carrying out extraction processes in the system "solid - liquid", thermostating, heating and cooling of the product.

## **Advantages:**

Provides an opportunity, depending on the technology of obtaining extracts in the installation of medicinal plant raw materials to process at a given temperature with a liquid extractant by maceration, remaceration, percolation, repercolation.



**Patents of Ukraine:** № 78455.

## **Basic technical characteristics**

Total volume of percolators, l	63
Number of percolators, pcs	2
Rated power, kW	10
Percolator heating time from 20 to 50 °C, min	20
Extractant	water / water-alcohol solution
Rated voltage, V	380
Type of current	variable
Current frequency, Hz	50
Overall dimensions, mm:	
length	2800
width	1800
height	2600
Weight, kg	830

**Implementation:** Pereyaslav Food Factory (Pereyaslav-Khmelnytsky).

# INSTALLATION "SIBERIA-600"

## **Appointment:**

Production of galenic preparations in the pharmaceutical industry by percolation with a variable direction of flow of the extractant: tinctures, infusions, syrups, extracts and balms from medicinal plant raw materials by percolation-pulsation method.

## **Basic technical characteristics**

Number of percolators	2
The total number of cassettes	8
The total volume of percolators, l	not less than 600
Rated voltage, V	380/220
Type of current	variable
Current frequency, Hz	50
Installed power, kW	to 22
Overall dimensions, mm:	
length	3460
width	1650
height	2200
Weight, kg	900

**Patents of Ukraine:** № 78455.



## **Advantages:**

Ensures the achievement of deep percolation, which allows more complete depletion of raw materials. Filtration of the extractant through the raw material layer allows to accelerate the extraction process, and the laminar regime of the extractant passing through the raw material prevents the leaching of ballast substances and the formation of stagnant zones.

**Implementation:** Begrif LLC (Berdsk).

# INSTALLATION "BAL'ZAM"



## Appointment:

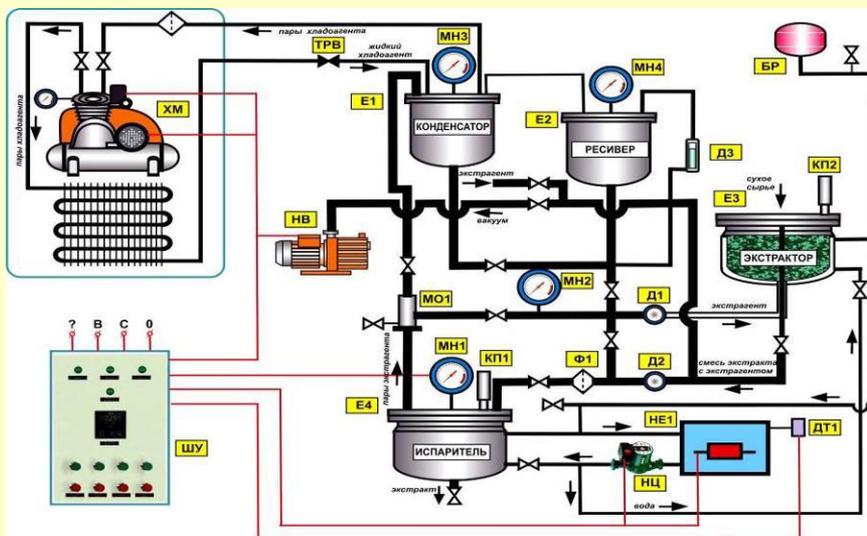
Extraction of oil from medicinal vegetable raw materials having oil, by the method of extraction with a liquefied gas-solvent, such as freon, followed by distillation of the solvent from the extract.

## Advantages:

The extraction installation works continuously and automatically. The extractant is circulated repeatedly until the raw material is completely depleted. A concentrated solution of extractives remains in the evaporator.

## Basic technical characteristics

Number of percolators	2
The total number of cassettes	8
The total volume of percolators, l	not less than 600
Rated voltage, V	380/220
Type of current	variable
Installed power, kW	to 22
Overall dimensions, without control cabinet and water heater unit,, mm:	
length	3460
width	1650
height	2200
Weight, kg	900



**Implementation:** CJSC "Liktravy" (Zhytomyr).

**Patents of Ukraine:** № 35293.

# INSTALLATION "RIGA-200"

## **Appointment:**

Production of tinctures, infusions, syrups, extracts, balsams from medicinal raw materials of plant and animal origin by percolation method.

## **Advantages:**

Provides energy saving, resource saving, improved quality of medicines, improved working conditions, intensification of heat and mass transfer processes.



## **Implementation:**

CJSC "Liktravy" (Zhytomyr).

**Patents of Ukraine:** № 35292.

## **Basic technical characteristics**

Total volume of percolators, l	200
Number of percolators, pcs	2
Rated power, kW	50
Percolator heating time from 20 to 50 °C, min	20
Average hourly electricity consumption, kW / h	6,0
Steam operating pressure in a steam jacket, MPa	0,045
Rated voltage, V	380
Type of current	variable
Current frequency, Hz	50
Overall dimensions, mm:	
length	2600
width	1600
height	2200
Weight, kg	1000

# THE DESTINKER VACUUMS FOR MILK

## **Appointment:**

For primary processing of raw milk in order to remove foreign odors and tastes.

## **Advantages:**

- ✓ high efficiency;
- ✓ small dimensions;
- ✓ low specific energy consumption.

## **Efficiency:**

Deep deodorization and processing without loss of raw materials.

## **Basic technical characteristics**

Productivity, l/h	5000	10000
Temperature of milk is on included in a vehicle, °C	4 ÷ 10	4 ÷ 10
Temperature of heat treatment of milk, °C.	70 ÷ 95	70 ÷ 95
Set power, kW, no more	16,5	27,5
Sizes, mm	1300x1100x1400	1500x1200x1450
Mass, kg, no more	300	450



## **Patents:**

Patent of Ukraine 65304, IPC A01J 11/00, A23C 1/00, A23C 3/00, A23C 7/00. Method of milk deodorization and device for its implementation.

# APPARATUS FOR MILK PROCESSING

## **Appointment:**

To improve the quality of raw milk and finished products.

## **Advantages:**

- ✓ environmentally friendly method of processing without the use of additives;
- ✓ improving the quality of raw milk due to deodorization, reducing acidity, increasing heat resistance, soft homogenization, suppression of microflora.

## **Efficiency:**

- ✓ increasing the shelf life of drinking milk to 14 days;
- ✓ reduction of milk acidity by 1-4 ° T;
- ✓ slowing down the rate of acidity during storage;
- ✓ increase of heat resistance on 1-3 groups;
- ✓ reducing the level of formation of aggregates of fat globules.

## **Basic technical characteristics**

Productivity, t / h	5÷15
Installed power, kW	27,0÷37,5
Weight, kg	800÷1100
Dimensions (maximum)	2200x1800x1700



**Patents:** Pat. 5683, IPC A01J 11/00, A23C 7/00. Method of milk homogenization and device for its implementation. Pat. 13597, IPC A01J 11/00, A23C 1/00. The method of homogenization of milk. Pat. 34954 A, IPC A23C 3/00. A method of manufacturing pasteurized milk with an extended shelf life. Pat. 50987, IPC, A23C 7/00, A01J 11/00. Apparatus for vacuum processing of milk.



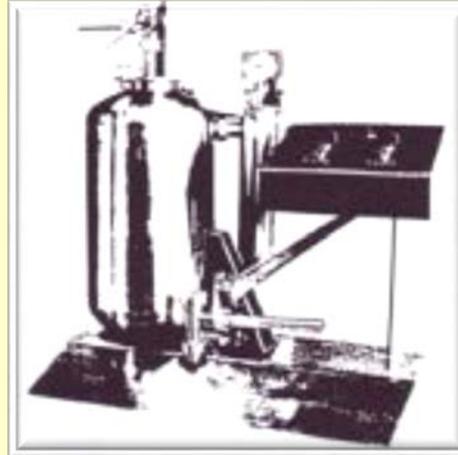
# VACUUM EMULSIFIERS

## **Appointment:**

To obtain milk-fat emulsions, liquid substitute for whole milk, emulsions based on vegetable and animal fats, etc.

## **Advantages:**

- ✓ obtaining highly stable concentrated milk-fat emulsions;
- ✓ low energy consumption for emulsification.



## **Basic technical characteristics**

	EV - 05	EV - 01	EVC
Productivity, t / h	0,5	1,0	0,8
Power consumption, kW	5,0	7,0	5,0
Weight, kg	400	500	550
Dimensions, mm	800x500x1600	600x500x1600	900x700x1500



## **Patents:**

Pat. 13596, IPC B01F 7/28. Device for mixing liquids. Pat. 19901, IPC A23C 11/00. The method of obtaining a liquid substitute for whole milk. Pat. 19911, IPC, A23C 11/00. A method of producing a powdered whole milk substitute.

# ROTOR-PULSE APPARATUS FOR DISSOLUTION OF DRY BULK FORMS OF FOODSTUFFS

## ***Appointment:***

For milk powder recovery, juice homogenization, etc.

## ***Advantages:***

- ✓ high efficiency of interaction of a product and solvent;
- ✓ high degree of dissolution of the product.

## ***Patents:***

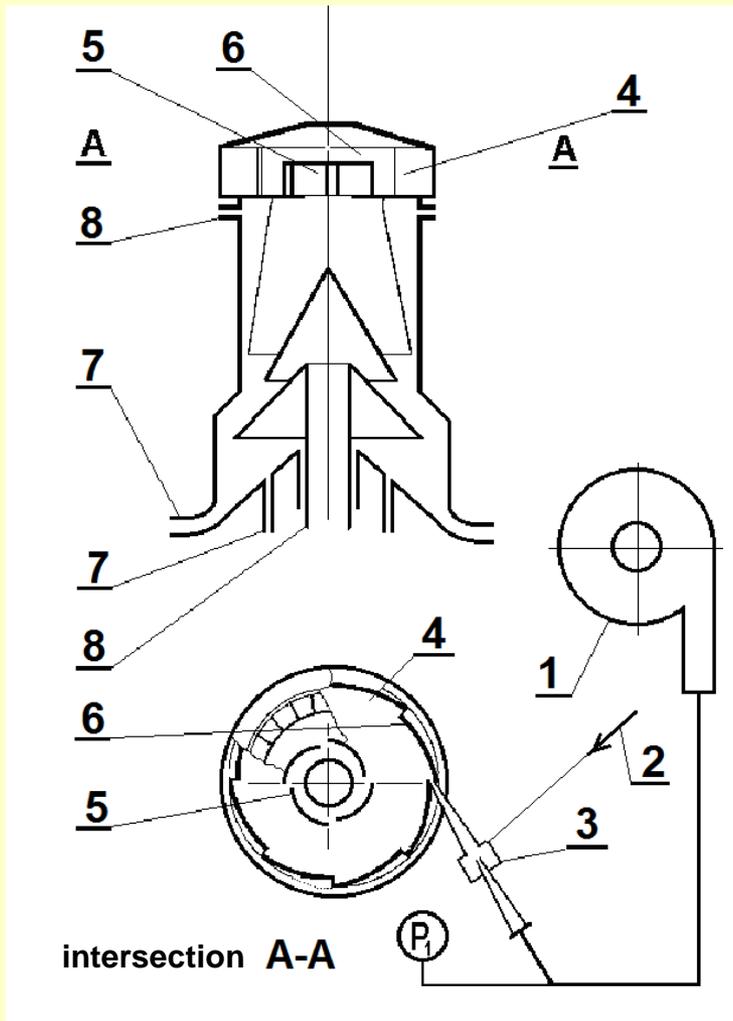
Pat. 6668, IPC A23C 9/00. Device for dissolving dry bulk dairy products.

## **Basic technical characteristics**

Productivity, t / h	10
Power consumption, kW	1,5
Weight, kg	95
Dimensions, mm	600x700x1100



# VORTEX MILL



1 - compressor; 2 - crushed material; 3 - ejector;  
 4 - grinding chamber; 5 - reflector; 6 - plate;  
 7 - yield of coarse material; 8 - yield of thin material.

## **Appointment:**

Grinding of various products, surface treatment, peeling.

## **Advantages:**

- ✓ increased yield of fine fraction (less than 6 microns);
- ✓ ability to adjust performance;
- ✓ combination of grinding with drying and separation.

## **Efficiency:**

When grinding copper powder efficiency = 7.8%

## **Basic technical characteristics**

Material consumption, kg / s	1,08
Air consumption, kg / s	6
Input pressure, kPa	700
Power consumption, kW	2,3
Height / diameter, m	1,2 / 0,6

**Patent of Ukraine:** № 12480A.

# SETTING FOR NEUTRALIZATION OF SOUR RUNBACK OF SMOKE GASES BY THE NONCHEMICAL METHOD



## **Appointment:**

Neutralization of acid condensate of combustion products of flue gases of hot water and steam condensing boilers without the use of chemical reagents.

## **Advantages:**

- ✓ reuse of neutralized condensate in the preparation of water for boiler supply;
- ✓ no need for reagents for neutralization;
- ✓ rational use of water resources;
- ✓ no contaminated wastewater neutralization products.



## **Basic technical characteristics**

Productivity, t/h	to 1,2
pH of acidic condensate, not lower	4,2
pH of neutralized condensate, not lower	6,0
Specific electricity consumption for 1t , kWh	3,2
Dimensions, mm	750x800x1100
Mass, kg	to 300
Estimated boiler heat power , MW	to 10

## **Efficiency:**

- ✓ complete avoidance of effluents of chemically contaminated neutralized condensate - up to 0.14 m<sup>3</sup> from 1 MW of heat power of a boiler;
- ✓ the reduction in the amount of wastewater from water softeners is proportional to the proportion of neutralized condensate used to supply the boiler.

# EXTRUSION TECHNOLOGIES

## **Appointment:**

To obtain pasty and granular mixtures for the agricultural direction with a long shelf life, the ability to adjust the composition and concentration of the product.

## **Advantages:**

The proposed auxiliary equipment allows to use the heat of extrusion released at the outlet of the matrix to pasteurize the mixture in obtaining pastes and the adhesive properties of the flow of particles for spraying powder components in obtaining granular mixtures, which reduces energy consumption by up to 30% compared to traditional technologies preparation of wet feed.

## **Basic technical characteristics**

Productivity on pasty mixes, kg / h	500
Productivity on granular mixes, kg / h	300
Power consumption, kW	37
Weight, kg	1100
Length, mm	3000
Width, mm	1970
Height, mm	1850

## **Efficiency:**

- ✓ increasing the shelf life of pasty mixtures to 3 months;
- ✓ reduction of energy consumption by up to 30%, compared to traditional technologies of wet feed preparation.

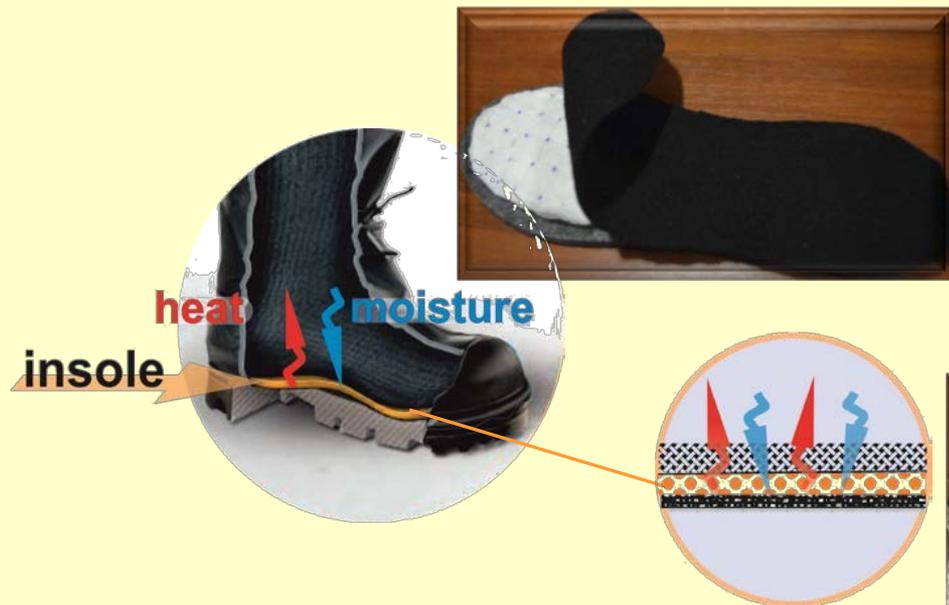
## **Patents:**

Pat. 51042, IPC B05B 13/00, A61J 3/00. Device for obtaining granular product;

Pat. 55174, IPC B01F 7/00. The line for obtaining a pasty product.



# MULTIPLE-USE MOISTURE-ABSORBING REGENERATIVE INSOLES FOR SERVICEMEN



Thermo insoles are designed to create comfortable conditions for the feet due to the optimization of the thermal regime of the foot, moisture absorption and bactericidal action of sorbents.

Moisture-absorbing thermo insole consists of three layers: the top layer is made of vapor-permeable material; the medium layer is hydrophilic sorption absorbent material; the lower layer is made of a hydrophobic insulating material.

