MECHANICAL ENGINEERING AND MACHINE BUILDING

TECHNOLOGY IMPROVEMENT FOR MANUFACTURING AND REPAIR OF COLLAPSIBLE PIPELINES

page 4–8

Application of arc brazing technology for manufacturing and repair of collapsible pipelines to replace arc MIG/MAG welding was proposed. The use of this technology to connect galvanized elements of collapsible pipelines preserving the protective coating in the joints was analyzed and justified.

Strength of samples of welded and brazed joints, galvanized pipes, collapsible field pipelines by tear test was investigated and strength characteristics of joints defined by measuring the hardness of a section connections was defined.

It was found that joints made by arc brazing by $CuAl_8$ filler rod have the strength level of the welded joints. Due to the small thermal effects, with arc brazing, there is no destruction of the protective zinc coating at the joint place.

Research results allow recommending arc brazing technology by $CuAl_8$ filler for manufacturing and repair of collapsible pipelines, preserving strength joints without destruction of the protective zinc coating at the joint place.

Keywords: arc brazing, zinc coating, brazed seam, mechanical testing, joint strength, tensile force.

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EXPERIMENTAL INVESTIGATIONS INFLUENCE OF LENGTHS BARREL PISTOL ON BALLISTIC CHARACTERISTICS BY USE OF LONG-TERM STORAGE AMMUNITION

page 9–21

Changes in physical properties of powder charges during their long-term storage have negative effect on the ballistic properties of 9 mm cartridges: the longer storage of ammunition — the greater the negative impact of this phenomenon.

The paper presents a method of predicting the initial velocity of some cartridges based on the respective values of initial velocity of other pistols. The error of the predicted data ranged from 0,12 % to 1,98 % depending on the barrel length and ammunition storage period.

It is proved that pistols with a longer barrel have larger deterioration in ballistic performance when used long-term storage ammunition than similar models with a shorter barrel. When comparing pistols PM, «FORT» and APS these deteriorations are 4 %, 4,84 % and 5,88 % respectively.

The main reason for this factor using long-term storage ammunition is aging of powder charge. The consequence of this phenomenon is difficult to forecast change in the characteristics of the powder charge. This in turn reduces valuable work carried out by burning dust, and is the main driving force through which must be achieved performance inherent in the characteristics of weapons.

Keywords: pistols, barrel length, initial cartridge velocity, long-term storage ammunition.

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ENERGY, ENERGY-SAVING TECHNOLOGIES AND EQUIPMENT

THE EXPERIMENTAL INVESTIGATION OF PRECISE INTELLIGENT THERMOANEMOMETRIC FLOW METER FOR BIOFUEL

page 22–26

The paper presents the constructions of fine thermoanemometric flow meter for biofuel (TAFM) as well as the results of its experimental research. The flow meter contains neural processor to compensate dynamic errors because of theirs essential value. Neural processor using as a part of TAFM significantly raises its accuracy. The latter is confirmed by the results of experimental researches on the specially designed unit, particularly by calibration and verification. The results of experimental researches determine that during the work of TAFM on biofuel when changing in the ranges of temperatures 0...180 °C the errors do no exceed 0,2 %. It is stated that the reasons for TAFM errors can be the errors of etalon sensors and thermal sensors which are a part of TAFM, the changes of fuel volume, measuring tank volume also influence the biofuel temperature as well as the environment temperature. This development can be used for accounting consumption of biofuel of vehicle engine. This approach will significantly improve their conditions of work in comparison with diesel fuel, decrease biofuel consumption as well harmful engine emissions.

Keywords: thermoanemometric flow meter, biofuel, thermoanemometer, neuroprocessor, measurement error, calibration, flow, temperature drop.

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DETERMINATION OF ELECTRICITY PRICES FOR INDUSTRIAL CONSUMERS

page 26–32

Based on the physics of normal electric power transmission, the paper proposes a new, science-based approach to determining the wholesale and retail electricity prices for industrial and equated consumers, which is accounted the effect of schemes for their power from the power system and reactive load on the economy of electric power transmission process.

Given the fact that pricing in the electricity system is the basic system calculation that determines the economics of its operation, it is proposed to conduct three levels: selling price; wholesale price; retail price.

In the article is scientifically based the principles for determining the selling, wholesale and retail electricity prices, which takes into account the physics of the impact of voltage electricity network on pricing (as a potential form of electricity) that feeds consumer, its active loss and bandwidth depending on the concept consumer connection to electric networks of electric power transmission organizations (as the basis of the methodology for determining wholesale prices) and reactive power load for specific electricity consumer (as the basis of the methodology for determining the retail price) for the consumed electricity in the current period.

Keywords: electricity, electric power supply, selling price, wholesale price of electricity, retail price of electricity.

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THE DEVELOPMENT OF THE METHOD OF MAINTANING THE SOIL DISCHARGE IN THE HEAT PUMP ENERGY SUPPLY

page 33–39

A method of maintaining the soil discharge based on prediction of soil temperature changes when measuring the temperature of the brine at the outlet of the heat pump evaporator is proposed. Using the resulting integrated system for assessing change in soil temperature as part of a dynamic system: soil heat exchanger – heat pump evaporator allows to make decisions about change the brine flow rate based on the change of motor speed of circulation pump and to establish the exact soil discharge period. Maintaining soil discharge based on prediction of soil temperature changes allows, for example, reduce the cost of heat production and heat pump system payback within 15–25 % for manufacture of year 47 GJ · year of heat by saving electrical energy at a frequency regulation of the motor of the circulation pump, which in monetary is equivalent to 30 % of the overall savings provided by the replacement of natural gas.

Keywords: heat pump system, soil heat exchanger, mathematical and logical modeling, decision making.

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INFLUENCE OF THE CONSTRUCTIVE PARAMETERS OF HEAT-ACCUMULATING ELECTRIC CONVERTER ON ITS ENERGY CHARACTERISTICS

page 39–44

The heat-accumulating electric energy converter based on direct heating of heat-accumulating substance through which electric current runs is offered for autonomous sources of heat water-supply. Three phase construction of heat-accumulating electric energy converter is considered. The mathematic model of converter and computer program of electric power and temperature in each elementary tank's volume has been worked out. The dependences between geometrical sizes and converter's electro-thermal characteristics are received. The technique of determining the optimal constructive parameters of the main heat-accumulating electric converter for solar heating systems using the proposed mathematical model is considered. Optimal constructive correlations of converter are received. Natural experiments to determine electro-thermal characteristics of converter have been conducted. The test results of research have been conducted. Economic effect of convertor's using in solar heat-supply systems is expected by reducing natural gas consumption for heat water supply.

Keywords: direct heating, heat-accumulating electric energy converter, method of secondary sources, mathematical model.

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IMPROVING THERMODYNAMIC PERFORMANCE OF REFRIGERATOR CONDENSER USING NANOPARTICLES

page 44–50

Data about the effect of nanoadditives on the work of heat exchangers of small refrigerator in the literature are practically absent. It is difficult to find technical solutions aimed at improving the efficiency of small refrigerators.

Thus, work on further research of small refrigerators with nanofluids as the working body becomes actual.

Reduce the electricity consumption of refrigerator is possible by improving the efficiency of heat exchange systems. New heat transfer fluids with better thermodynamic characteristics are one option to improve heat transfer. An important achievement in the study of heat transfer fluids is the use of a colloidal mixture of primary coolant liquid and metal particles with the size of 1–100 nm. Initial versions of colloidal solutions, such as microfluids, resulted in formation of a precipitate, causing erosion of the friction surfaces of metal parts. Nanofluids are unconnected monoparticles located in the base fluid. Their use can increase the heat transfer more than 50% in actual refrigerators of heat exchangers even when the relative amount of nanoparticles is less than 0,3 %.

The paper compares the parameters of the condenser of small refrigerating machine using pure refrigerant and nanoparticle additives. Further, a comparison of theoretical calculation and experimental data of the condenser are conducted. The experiment revealed that the use of nanoadditives increases the heat transfer coefficient by 16 % in comparison with the pure refrigerant, which makes them promising means of improving the efficiency of the refrigerator without requiring structural changes.

Keywords: refrigerator, nanoparticle, nanoadditive, heat transfer coefficient, condenser, isobutane.

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EXPERIMENTAL INVESTIGATION OF LIQUID-VAPOR EJECTOR WITH CONICAL MIXING CHAMBER

page 50–55

The article is devoted the design of working process of liquid-vapor ejector of a vacuum unit with conical mixing chamber, working on principle of jet thermal compression, research of influence of thermodynamic parameters and descriptions of active and passive streams on the process of mixing with the purpose of achievement of most vacuum unit efficiency.

The main content of the article is study the nature of passive mixing flows with different thermodynamic properties on the geometric parameters of the mixing chamber.

Experimental study of liquid-vapor ejector with conical mixing chamber on a transparent model allowed to confirm the mechanism of the working process at pressures below atmospheric pressure, namely the boiling of metastable superheated liquid, characterized by the presence of three critical sections expiry of expanding the channels to the definition section of flow separation from the walls of the channel and its position relative to the nozzle exit of active flow. Also the nature of the mixing process in the chambers of conical shape is investigated. It allows establishing maximum efficiency by optimizing the flow of liquid-vapor ejector with conical mixing chamber.

The estimation of the appropriateness of units on the basis of LVE in vacuum systems through a comparative exergy analysis of basic and alternative schemes offered by the method of J. Tsatsaronis.

Keywords: liquid-vapor ejector, conical mixing chamber, experimental investigation, exergy effectiveness.

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ELECTRICAL ENGINEERING AND INDUSTRIAL ELECTRONICS

COMPARATIVE ANALYSIS OF THE CHARACTERISTICS OF INSULATING VEGETABLE LIQUIDS FOR HIGH VOLTAGE ELECTRICAL EQUIPMENT

page 56–62

This is a summary of investigations of influence of raw vegetable materials on the characteristics of liquids which can be used as an insulator in high voltage electrical equipment. Raw materials influence not only the initial characteristics of produced liquids, but also on changes in these parameters while they're being used. In presenting the results of research attention is given to achieving the desired characteristics of the thermo-oxidative stability of such liquids, the differences of the aging process in which paper insulation, possibilities of diagnostics of defects on the basis of gasification equipment control. It is noted that the use of different vegetable raw materials leads to differences in the manufacturing process and use of these liquids. Among the positive effects of the use of insulating vegetable liquids in high-voltage electrical equipment, one can note an increase in durability of cellulose insulation in them. However, usage of such equipment will require development and application of techniques for its control which differ from those which are conventionally used for mineral oils.

Keywords: insulating vegetable liquids, aging, moisturizing, flatulence, insulators of high-voltage electrical equipment.

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COMPARISON OF THE DYNAMICS OF LIGHT AND COLOR CHARACTERISTICS OF COMPACT FLUORESCENT AND LED LAMPS IN PROCESS OF SERVICE LIFE

page 63–69

The results of the comparative study of light and color characteristics of compact fluorescent (CFL) and LED lamps in the process of service life are shown.

It is shown that commercial samples of LED lamps, which come to the Ukrainian market, have an advantage over CFLs on service life, luminous efficiency, stability of light and color parameters in the process of service life. Lumen maintenance factor of the investigated CFL parties after 6000 hours is 77–62 %. CFLs color temperature in the process of service life is reduced for 6000 hours approximately 100–300 K for lamps with a color temperature of 2700–4000 K for the lamps of 13–32 Watt and 600–900 K color temperature of 6500 K for the lamp of 55–85 Watt.

Lumen maintenance factor of the investigated parties of LED lamps after 6000 hours is 99–93 %. Deviation of the chromaticity coordinates of the initial value of 6000 hours no more than one degree of MacAdam ellipses. The color temperature is changed at the same time not more than 100 K.

The cost of the light energy generated by modern light sources is calculated. Cost of light energy unit using LED lamps below, compared with CFL, about 1,3 times for electricity tariffs and prices for the lamps in Ukraine in May 2016.

Keywords: compact fluorescent lamp, LED lamp, luminous efficiency, color temperature, chromaticity coordinates, service life.

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ANALYSIS OF CAPACITIVE CURRENTS IN THE WINDING OF A HIGH VOLTAGE MEASURING AUTOTRANSFORMER

page 70–76

The paper analyzed the distribution of capacitive currents in the winding of measuring high-voltage autotransformer at its operating frequency 50 (60) Hz. It is revealed that idling high-voltage autotransformer at significant nominal dividing coefficient these currents can acquire essential values against the current idling, which can affect the accuracy of large-scale conversion of high-voltage measuring autotransformers. The paper presents an approach to account values of interlayer capacitive currents in the windings of high-voltage autotransformers to clarify the distribution of voltage on their low-voltage (output) winding parts. It is shown that the distribution of capacitive currents significantly different to the first, last and middle layers of windings that must be considered when designing the windings of high-voltage autotransformers and calculate the number of turns in the respective high-voltage and low-voltage parts of windings. This analysis is particularly important for the development of standard measurement tools using high-voltage autotransformer scale transformation.

Keywords: voltage autotransformer, capacitive current, voltage drop, interlayer capacitance.

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