

The Academic Coordination Centre in the Euroregion Nisa (ACC)

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INDEPENDENT ELECTRONIC AIR CONTROL OF THE FIREPLACE STOVE





Historical Development





9-screens



For better systematic thinking...



Shape of Fireplace Stoves



Exist many kinds of Fireplace Stoves



The Air in the Fireplace Stove



What is an Air Damper?



It is equipment for control of the air...



Example, where is the Air Damper?



Modern control of the Air



Semi-automatic Regulation CZ2009823A3



2D Drawing with New Solution



Independent Automatic Regulation



New Solution Advantage





It is independent Automatic Regulation



3D Model



For control of the air...



Schema of the Electronic Wiring Diagram



example with hobby Arduino



FEM Analysis of the Air



This one is for Primary Air.



Diagram Dependence of the Angle and Velocity



For Primary Air



Operational Test



Reality is a green tree of the Life...



Results and Discussion

The manufacture and installation of electronic air control equipment revealed: A minor design imperfection, because appropriate adjustments were therefore made to the controller shaft guide (bearings and holes).

An operational test has shown that it is most likely not necessary to use a throttle compression spring.

The pressure uses gravity and is developed by the weight of the damper itself.

The throttle moves in the desired trajectory without scrubbing and squeaking.

The openings (holes) where the manual control handle moves (in the event of a power failure) are sufficiently sealed.

The test results also show that the original idea to build an electronic system on a "hobby" arduino for the prototype phase is correct. Although for industrial use it will be necessary to use more sophisticated equipment integrated into the printed circuit board.



Conclusion

The main advantage of regulation lies in the independent divide of the primary and secondary air and in the purity of combustion.

With normal stoves, it is possible to degrade the purity of flue gases and other measured quantities to a level that does not comply with the EN 13240 standard (or German Din + and Austrian A 15) by incorrectly setting the ratio of primary and secondary air.

Adjusting the air according to the test in the test room is almost impossible for a layman with normal stoves.

In contrast, with automatic control, the ratio is set automatically.

The regulation works on the principle of sensing the flue gas temperature and then according to the flue gas temperature, which is sensed by a sensor, the dampers divides the ratio of primary air coming under the grate and secondary air (air passing through channels and along the glass - supports the purity of wood burning).



Conclusion

The innovation of setting the air passage of fireplaces has met with success.

3D model was created, and device was virtually analyzed using the finite element method.

The equipment was manufactured and thanks to FEM analysis with only local minor modifications occurred and the system was physically tested with acceptable results.

What is important for the following research steps:

≻make whole fireplace stoves with modular independent control of primary and secondary air

>perform comprehensive operational testing and possible further development of the system.

The world is moving forward, towards environmental protection. Electronic air control in the fireplace stove is just a fragment. However, the individual fragments form the overall mosaic of the sustainability of the planet.



Thank You for Your Attention



Literature

[1] K. Sornek, M. Filipowicz, a K. Rzepka, "The development of a thermoelectric power generator dedicated to stove-fireplaces with heat accumulation systems", *Energy Convers. Manag.*, roč. 125, s. 185–193, říj. 2016, doi: 10.1016/j.enconman.2016.05.091.

[2] P. L. Gross, N. Buchanan, a S. Sané, "Blue skies in the making: Air quality action plans and urban imaginaries in London, Hong Kong, and San Francisco", *Energy Res. Soc. Sci.*, roč. 48, s. 85–95, úno. 2019, doi: 10.1016/j.erss.2018.09.019.

