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Patent Portfolio Valuation Rapport

Innenco Sweden AB

Groth & Co
2021-05-31



Executive Summary

In our analysis, we have applied a qualitative income based method. The estimated patent portfolio value reflects the patent portfolio potential as of today taking into account legal risks. The legal risks have been quantified using a model approach based on empirical data.

Innenco has a patent portfolio comprising 1 patent family including 1 granted patent and 3 pending patent applications.

The legal status of Innenco Sweden AB's patent portfolio is at a medium level due to a relatively narrow scope of protection and a geographical coverage which is less than ideal. This results in a legal discount factor of approximately 0.6.

The current overall freedom-to-operate status of the Patent portfolio is concept freedom / product freedom. In other words, we have not found any patents which block the concepts/products searched.

Under the given assumptions and conditions thoroughly discussed in the valuation report, the indicative and estimated patent portfolio value is approximately **EUR 23.3 million** within an interval of EUR 6.9 to 46.6 million.

To conclude, we would like to address the following issues and reflections:

(i) This analysis is based on the situation as of today, but the situation is likely to change over time. Factors such as patent portfolio lifetime and new competing patents will affect the estimated patent portfolio value. Strategic and continuous patent work to strengthen the technology would likely counter value reduction of the patent portfolio potential as well as counter increase of the legal risk discount.

(ii) In this study, only patents have been included. Other types of IP, such as design rights, trademarks, know-how, copyright etc. have not been considered.

Stockholm May 31, 2021



1. Introduction

Groth & Co (“Groth”) is a leading IP law firm with head office in Stockholm, Sweden.

Groth is a Swedish limited liability company incorporated under Swedish law. The company is partner owned. Groth advises on all aspects of IP, including patents, trademark and design rights. Groth has been creating and optimizing intellectual property since 1869 which makes Groth Scandinavia’s oldest company in the industry. Groth have experts in patents, trademarks, designs, domain names, copyright, process & litigation, watching and name creation.

The Groth team in this project has consisted of:
Claes Westerlund, Partner, European Patent Attorney
Tommy Vikholm, European Patent Attorney

2. Scope of project

Groth & Co have been instructed to assess an indicative value estimate of the patent portfolio of Innenco Sweden AB (“Innenco”).

2.1 “Information input”

- The Inneco patent portfolio handled by Zacco (transferred to Ström & Gulliksson in May 2021)
- Questionnaire (Appendix A)
- Qualitative evaluation of the Innenco’s patent portfolio (Appendix B)
- Details regarding Legal status assessment (Appendix C)
- Freedom to operate search and analysis (Appendix D)
- Innenco International AB Financial Analysis report, report by Listing Partners, 2018
- Business Plan Innenco Sweden AB

2.2 Methodology

The valuation estimate is based on a qualitative method briefly described below.

The valuation estimate reflects an overall assessment of the patent portfolio. Hence, this valuation estimate cannot be used to extract a value estimate for an individual intellectual property right of the patent portfolio.

The estimated value of the patent portfolio is based on a patent portfolio potential derived from a business scenario based on research, statistics and assumptions, and verified by further data and interviews with the management of Innenco. The patent portfolio potential reflects a maximum potential of the patent portfolio.

The patent portfolio potential is multiplied with a legal risk discount factor to obtain the estimated value (figure 1):



Figure 1

The legal risk discount factor is based on:

- a) a set of value indicators.
- b) a freedom-to-operate status of the IP-portfolio (Appendix D).

An empirically based model has been used to find a quantitative measure of the legal risk.

2.2.1 The freedom-to-operate status

The freedom-to-operate status is determined according to the 10-graded scale below:

- 1) Concept freedom
- 2) Product freedom
- 3) Non-essential feature of product blocked by patent controlled by owner outside industry
- 4) Non-essential feature of product blocked by patent controlled by owner within industry
- 5) Essential feature of product blocked by patent controlled by owner outside industry
- 6) Product blocked by patent controlled by owner outside industry
- 7) Essential feature of product blocked by patent controlled by owner within industry
- 8) Concept blocked by patent controlled by owner outside industry
- 9) Product blocked by patent controlled by owner within industry
- 10) Concept blocked by patent controlled by owner within industry

“Concept freedom” indicates that not only a particular product is free to use on the market, i.e. not blocked by any third party patent, but also that the product concept is free to use without any hindrance from blocking patents. This score entails a multiplying factor higher than 1.

“Product freedom” indicates that a particular product is free to use on the market without being blocked by any third party patent rights. This score also entails a multiplying factor of 1 or higher than 1.

“Non-essential feature of product blocked by patent controlled by owner outside industry” indicates that a feature of low or minor importance in the product is covered by a patent owned by a party operating in another industry. Typically, the feature can easily be modified to circumvent the patent or has a very low value. This score entails a multiplying factor close to 1.

“Non-essential feature of product blocked by patent controlled by owner within industry” indicates that a feature of low or minor importance in the product is covered by a patent owned by a party operating the same industry. Typically, the feature can easily be modified to circumvent the patent and/or is cheap to replace. This score entails a multiplying factor close to 1.

“Essential feature of product blocked by patent controlled by owner outside industry” indicates that the product includes an essential feature that is covered by a third party patent



where the owner operates in another industry. Normally, this feature is difficult to modify and/or is expensive to replace. This score entails a multiplying factor lower than 1.

“Product blocked by patent controlled by owner outside industry” indicates that the product includes several essential features that are covered by a third party patent where the owner operates in another industry. Normally, it is not possible to modify these features and/or they are very expensive to replace. This score entails a multiplying factor lower than 1.

“Essential feature of product blocked by patent controlled by owner within industry” indicates that the product includes an essential feature that is covered by a third party patent where the owner operates in the same industry. Normally, this feature is difficult to modify and/or is expensive to replace. The fact that the owner operates within the same industry often lead to a high license fee or to difficulties in obtaining a license. This score entails a multiplying factor significantly lower than 1.

“Concept blocked by patent controlled by owner outside industry” indicates that not necessarily one or several essential features of the product is covered by a third party patent where the owner operates in another industry but that the concept including the product is protected by that patent. This score entails a multiplying factor significantly lower than 1.

“Product blocked by patent controlled by owner within industry” indicates that the product includes several essential features that are covered by a third party patent where the owner operates in another industry. Normally, it is not possible to modify these features and/or they are very expensive to replace. The fact that the owner operates within the same industry often lead to a high license fee or to difficulties in obtaining a license. This score entails a multiplying factor significantly lower than 1.

“Concept blocked by patent controlled by owner within industry” indicates that not necessarily one or several essential features of the product is covered by a third party patent where the owner operates in the same industry but that the concept including the product is protected by that patent. The fact that the owner operates within the same industry often lead to a high license fee or to difficulties in obtaining a license. This score entails a multiplying factor significantly lower than 1.

Of course, the above scale is general and has to be adapted to the specific characteristics and nature of the analysed industry. Therefore, the actual influence on a patent portfolio potential has to be determined from case to case.

2.2.2 The value indicators:

- Legal status
- Technological situation
- Market conditions
- Financial conditions
- Strategic profile

The value indicators are used as an input to provide an overall patent portfolio strength. In appendix C, we discuss these indicators in more detail.



3. Valuation procedure

3.1 Assumptions and limitations

3.1.1 Patent portfolio market coverage

Today, Innenco has a patent portfolio including 1 patent family. This valuation is based on the current patent portfolio. In the table below, the market coverage is summarized, where P indicates a granted patent (or intention to grant) and A indicates an application.

Country / Region	Sweden	EPO	China	India	USA	Middle east	Japan
Patent family 1	P	A	A	A			

3.1.2 Market potential and key assumptions

The figures used to estimate the market potential are taken from the valuation report “Innenco International AB Financial Analysis report” from 2018.

Based on experience from previous commercialisation projects based on patented technology, it is known that the patent protection contributes strongly to marketing value, sales and profits during the first years of commercialisation (“movers advantage”), whereafter the patent in general becomes less valuable. This is particularly the case when the breadth of the claims is narrow, as in Innenco’s patent portfolio. Competitors will over time develop substitute technology, and the contribution of the patent to company profits thus declines or even vanishes. A notable exception is pharmaceutical patents.

Considering the above, our model for estimating market potential does not consider the market potential during the whole term of the patent portfolio. On the contrary, only the market potential during a first number of years of substantial commercialisation is considered, but on the other hand it is considered that the patent contributes to the full market potential during this time period. In reality the patent portfolio will likely contribute to profits for a longer period of time, and to a successively declining extent (see also the discussion below in the section “Observations and Recommendations”). The relatively short period of time considered is also motivated by the difficulty in predicting revenue and operating margin for longer periods of time. In Innenco’s case we have therefore considered the time period 2021-2025. Considering the relatively short time period, future profits have not been discounted.

According to the above-mentioned valuation report, the estimated accumulated EBIT for the remaining time period 2021-2025 is USD 94,8 million, which corresponds to approx. EUR 77,7 million. We consider this a “best case” estimation, which can be motivated for example in that the revenue for the present year 2021 in Innenco’s more recent business plan is substantially lower (EUR 18,75 million) than in the valuation report.

A “worst case” estimation of EBIT may be achieved by starting from a lower revenue in 2021 (EUR 18,75 million for 2021), a lower growth in revenue (10% yearly, which could be motivated by possible delays in contracts for example) and a lower operating margin (10%). This results in EUR 11.4 million.



3.2 Patent portfolio Potential

Based on the circumstances and assumptions given, the patent portfolio potential is:

approximately EUR 38.9 million,

within an interval of approx. EUR 11.4-77.7 million.

3.3 Legal risk discount

The current overall freedom-to-operate status of the Patent portfolio is concept freedom / product freedom.

In appendix D, more details regarding the freedom-to-operate investigation are provided.

To determine the Patent portfolio strength, we have analysed (in Appendix B) five aspects of the IP position of Innenco:

Legal status: This category concerns the assessment of the patent as a legal document, i.e. the legal basis for maintaining and enforcing the patent and the company's ability and motivation to do so.

Technological situation: The focus of this category is on assessing the patent's technology, the prospects within the technology, and the technology's demands on the company.

Market conditions: This is an assessment of various factors and conditions affecting the marketing options of the patented technology and the business opportunities created when the patented technology is incorporated in one or more products. Relevant areas are the market's competitive situation, market growth, product life expectancy in the market, licensing opportunities, etc.

Financial conditions: The finance category concentrates on determining how the patented technology affects the financial structure in the business area where it is put to use.

Strategic profile: The strategy section focuses on categorizing the patent (the legal document) with a view to weighing the actual purpose of the patent against the qualitative and financial assessments.

In order to arrive at a quantified legal risk factor or discount, we have used a legal risk model based on empirical studies from a number of executed transactions with IP as an important factor. The legal risk model is graphically illustrated below in figure 2.

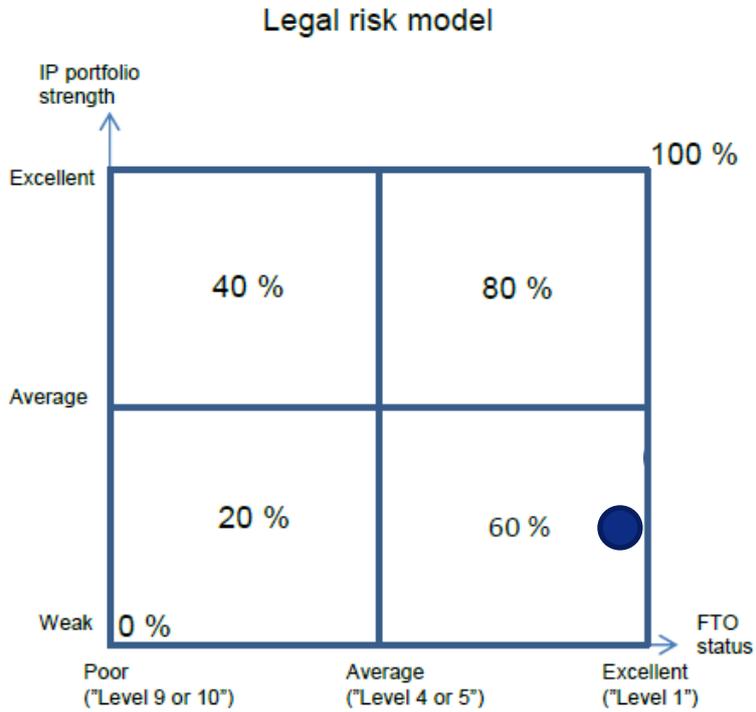


Figure 2

3.4 Estimated value of the Patent portfolio

Accordingly, adjusted for the legal risks, the estimated value of the Patent portfolio is:

approximately EUR 23.3 million,

within an interval of approx. EUR 6.9-46.6 million.

4. Observations and recommendations

The patent portfolio potential and the estimated patent portfolio value reflect the patent portfolio and legal risks as of today and under the circumstances and assumptions given in this report.

It should be noted that the potential patent portfolio value will likely decrease over time as illustrated in Figure 3 without a structured and continuous patent work within Innenco. The same applies to the legal risks and estimated value. The patent portfolio provides a “movers advantage” which is reduced over time if the patent portfolio is not continuously operated and improved. However, if a structured and continuous patent work is applied within Innenco, it is possible to achieve an increased patent portfolio potential as well as reduced legal risks and an improved estimated patent portfolio value.

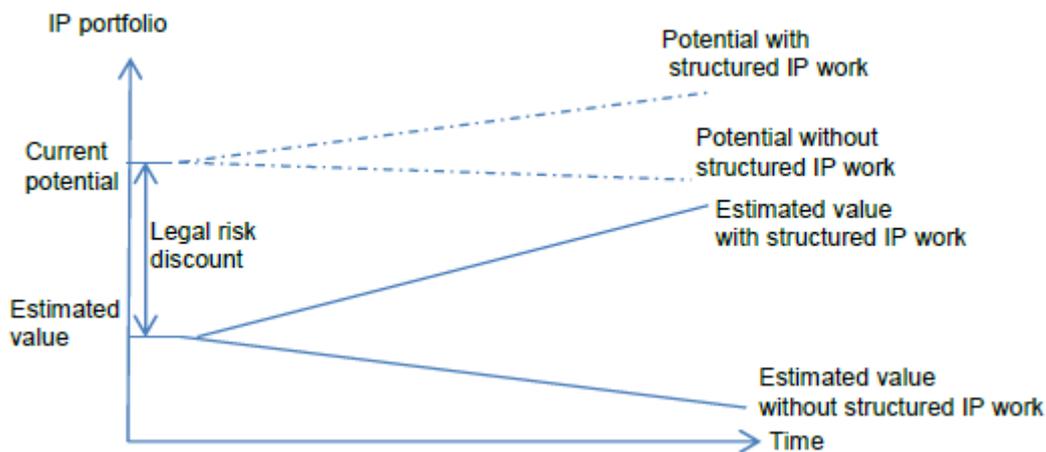


Figure 3

A decrease of patent portfolio potential over time may on the other hand be balanced by development of the patent families of today, for example, by more granted patents. Notwithstanding these facts, a general trend will be a declining IP potential and/ or increased legal risks over time without structured IP work.

If a structured patent work is adopted, we see possibilities in improvement of the patent portfolio, for example, in adding new patent families directed to processing of the products produced in the Innenco’s systems and technological development of the system.

The ownership of all patents considered in this analysis is in the control of Innenco.

Discussions with Innenco’s management and the questionnaire answered by the management have not revealed any information that may alter our assumptions and or indicate that the assumptions made in this analysis are erroneous or based on misleading information.



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5. General information and limitation of liability

This report should only be shared with another party under confidentiality and with great care. We do not assume any liability to any other party than Innenco for the content of this report.

This report is an Attorney work product and thus operates under Attorney Client Privilege. Therefore, the different parts of the report should not be separated.

To the extent that other law than Swedish law or issues relating to the European Patent Convention ("EPC"), for example, whether any IPR may infringe third party rights in a jurisdiction other than the above, a legal review in each country will be required. We have not obtained any legal advice from local expertise regarding the specific legal situation in the jurisdictions discussed in this report.

Please note that we do not provide any legal opinion or guarantee of any particular outcome if the issues addressed in this report should become the subject of court proceedings or similar. Nevertheless, this report reflects our best assessment as of today.

Stockholm May 31, 2021

Claes Westerlund



Appendix A: Patent questionnaire

1. Ownership

a. Who owns the rights and is there a possibility to transfer any of those of a third part?

Innenco Technology Ltd a fully owned Honk Kong subsidiary to Innenco Sweden AB.

b. Is there any other party that may have interest in the patents?

Not that we are aware

c. How is the ownership of the patents regulated?

100% Owned by the subsidiary Innenco Technology Ltd

d. Is there any other individual or party that may be considered as an inventor and/or may claim ownership to any patents?

Not that we are aware

e. Has the company lost sensitive/secret information, for example, due to loss of key persons?

No

2. Scope of protection

a. What is your view on the scope of protection of the patents in relation to the technology?

Only what our patent firm has informed us. They informed us that the current patents are approved and there are possibility to apply for further protection in some regions as well as update the current patent to include cooling and not just heating as it is today.

b. What is your view on the geographical scope of the patents in relation to your market?

That we need to continue to strengthen our patents , but we cover most markets where we operate now.

c. Is there a need of complementary patent protection? If yes, what kind of patents?

Not that we are aware. We have only been informed that we could update the current one because there the first patent only include heating while our system does both heating and cooling.

3. Validity

a. What is your view on the validity of the patents in relation to the technology and in relation to third parties?

That they are sufficient.



b. Are you aware of any obstacles to your patents or weaknesses in your patents that may reduce or eliminate your possibilities to enforce the patents? For example, by means of presentations or sales of patent protected material before the actual filing date?

Not that we are aware

c. Are you aware of any challenge to your patents by third party? For example, if there has been filed a third party observation or opposition to any of your patents?

Not that we are aware

4. Portfolio management

a. Who decides on patent matters in the company?

CEO

b. Describe the process for decisions in patent matters?

We work closely with the patent firm whom will advise the company on the best strategies in terms of patents then the management team takes the decision, and if there are major changes then the board would be involved as well.

c. What is your patent budget for 2021 – 2025?

5M€

d. How is the renewal fees handled?

Through our partner

e. Is there a model for inventor remunerations? If yes, describe the model?

No

5. Limitations and possibilities in relation to competitors

a. Are you aware of any limitations or obstacles to a commercialization of your technology due to third party IP?

No

b. Have you performed any "freedom to operate" investigations with respect to your products?

Not that we are aware

c. Are there any license agreements or other agreements connected to your patents? If yes, which are they?

No

d. Rank your most important competitors?



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e. Is there any regular monitoring of potential infringement in your patents? If yes, how does your company monitor potential infringements?

With the help of our patent firm

f. Have you identified any infringements in your patents? If yes, how have you dealt with these?

No

6. Technology

a. Which are the most important underlying trends that are beneficial for the technology?

The EU and UN global climate goals

Energy saving/sustainability regulations

b. Which are the most important technology threats to a commercialization of the technology? For example, is there a risk for a technology shift that would prevent or make it more difficult to commercialize the technology?

No

Appendix B: Evaluation of patent position of Innenco Sweden AB

Graphical overview with summaries

Innenco has 1 patent family including 1 granted patent and 3 pending patent applications (EPO, China, India).

The following evaluation has been conducted on the portfolio as a whole according to a method comprising five different categories of assessment factors, each a focal point on important elements for an overall evaluation of risks and potential inherent in the patent or development project. Altogether there are 40 assessment factors, each with a rating scale of 1 to 5 points, where 5 is the maximum (“best”) score. The assessment factors are divided into the following five input categories.

Legal status

This category concerns the assessment of the patents as a legal document, i.e. the legal basis for maintaining and enforcing the patents and the company’s ability and motivation to do so. The category looks at determining the patent’s present position in the grant process, how broad the patent’s claim is and how durable it is thought to be. Is the patent monitored with regard to infringements? And if so, does the company have the means to enforce the patent? Overall, the category provides a picture of the patent’s legal status and situation.

Technological situation

The focus of this category is on assessing the patent’s technology, the prospects within the technology, and the technology’s demands on the company. It looks at whether the technology can be substituted by other technologies, whether infringing copycat products are easy to produce, whether the technology has been tested and whether it creates a demand for new production skills/equipment. The category aims to provide an overall impression of the technology’s position of strength.

Market conditions

This is an assessment of various factors and conditions affecting the marketing options of the patented technology and the business opportunities created when the patented technology is incorporated in one or more products. Relevant areas are the market’s competitive situation, market growth, product life expectancy in the market, licensing opportunities, etc. This category creates an impression of the different factors and conditions which, when aligned with the patent’s legal status and the prospects in the technology, shows the potential inherent in the patented technology.

Financial conditions

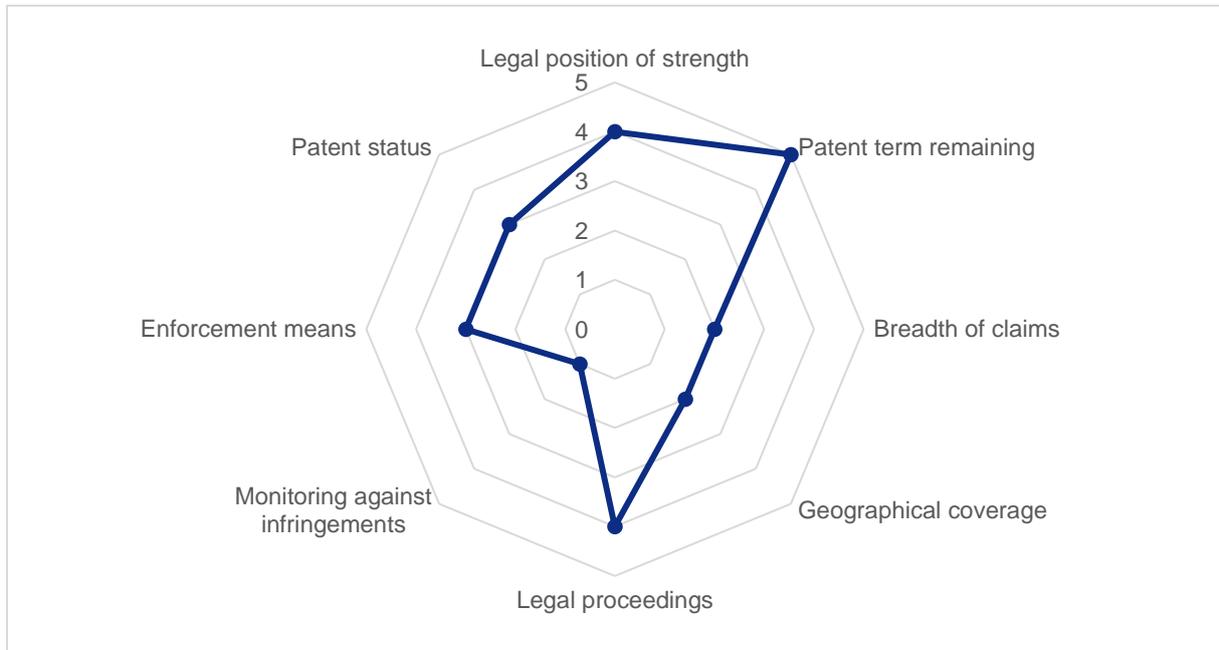
The finance category concentrates on determining how the patented technology affects the financial structure in the business area where it is put to use. It is an assessment of the future costs for product development and production and earnings, coupled with the importance of these contributions to the company’s total turnover, etc. It also assesses the investment needs for production equipment.

Strategic profile

The strategy section focuses on categorizing the patent (the legal document) with a view to weighing the actual purpose of the patent against the qualitative and financial assessments. The company assesses the purpose of the patent, how it intends to use the patent. Is the

patent a defensive tool, short-term and only attached to one product, or does it also have an offensive, long-term purpose, e.g. by securing the right to come up with new product developments in new markets and thus ensuring company enterprise options?

Legal status



The patent status of Innenco's patent portfolio is graded 3/5 since the most important parts of the patent family (patent applications in Europe, China, India) have status "Novelty search and patentability evaluation completed".

The relatively high legal position of strength of the patent portfolio (4/5) indicates that the patented technology has been subjected to novelty searches by three independent patent offices (PRV, EPO and CNIPO). No further relevant prior art should be expected. The remaining patent term is quite long (16-17 years), which entitles a score 5/5.

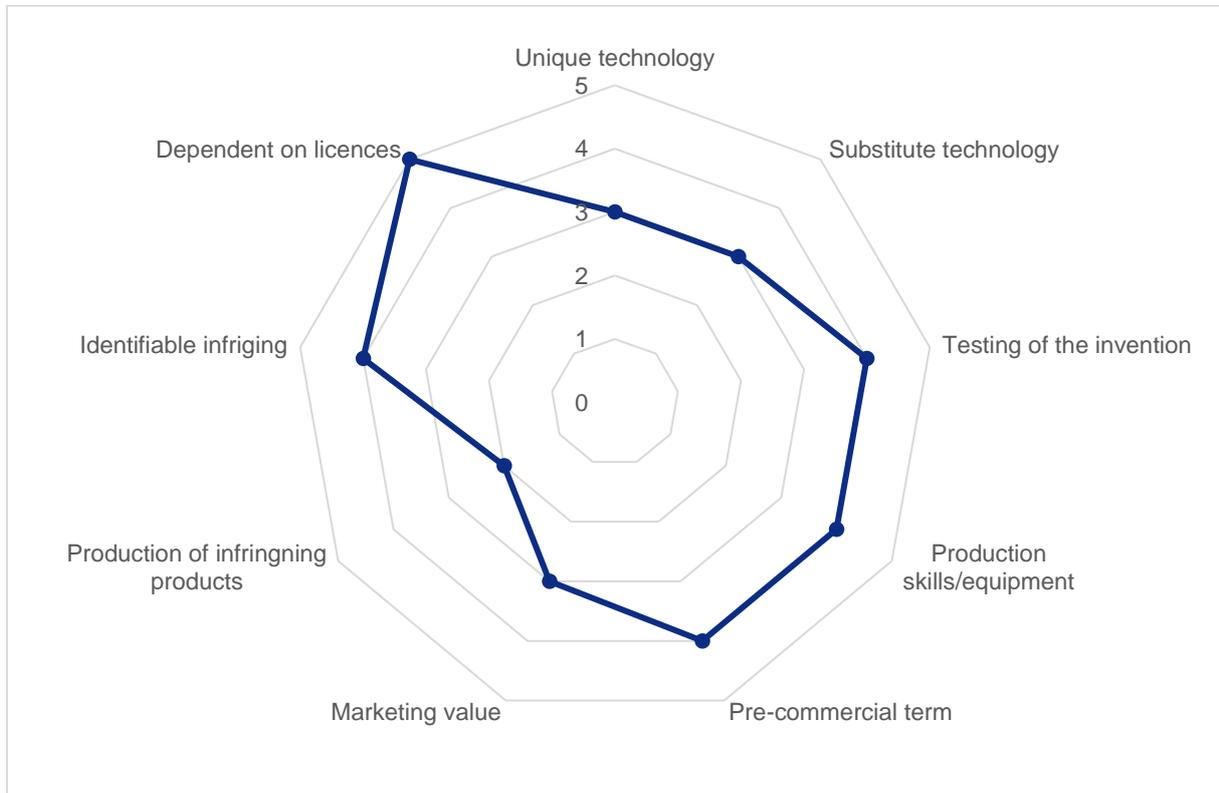
The claims of the granted Swedish patent are of relatively narrow scope since they are limited to a specific configuration of the distributor. EPO has given a positive patentability assessment only regarding claims having the same scope of protection as in the Swedish granted patent, which indicates that a possible EP patent will have the same scope. Competitors may choose another solution. The score regarding breadth of claims is thus 2/5.

The patent family has a geographic coverage which comprises applications in Europe, China, India. Very important markets (USA and the Middle east) are missing however, which results in a score 2/5.

No disputes or legal proceedings are presently known, but if noticeable market shares are obtained, larger competitors will likely attempt to use legal means against Innenco.

Innenco has no systematic monitoring against infringements to Groth's knowledge. Enforcement means is considered at medium level – enforcing patents in court proceedings involves considerable costs for a relatively small company.

Technological situation



Inneco's technology differs clearly from present technology, but patented technology relates to detail improvements of the distributor.

No substitute technology is presently known, but patented technology is limited to a specific configuration of the distributor. Competitors may choose another solution and use this with the non-protected concept on a macro level (distribution in whole building/community).

Several projects have been built/are planned, but further R&D and testing is to be expected. Testing of the invention and pre-commercial term are thus graded relatively high.

Product should not be significantly more difficult to produce than known technology.

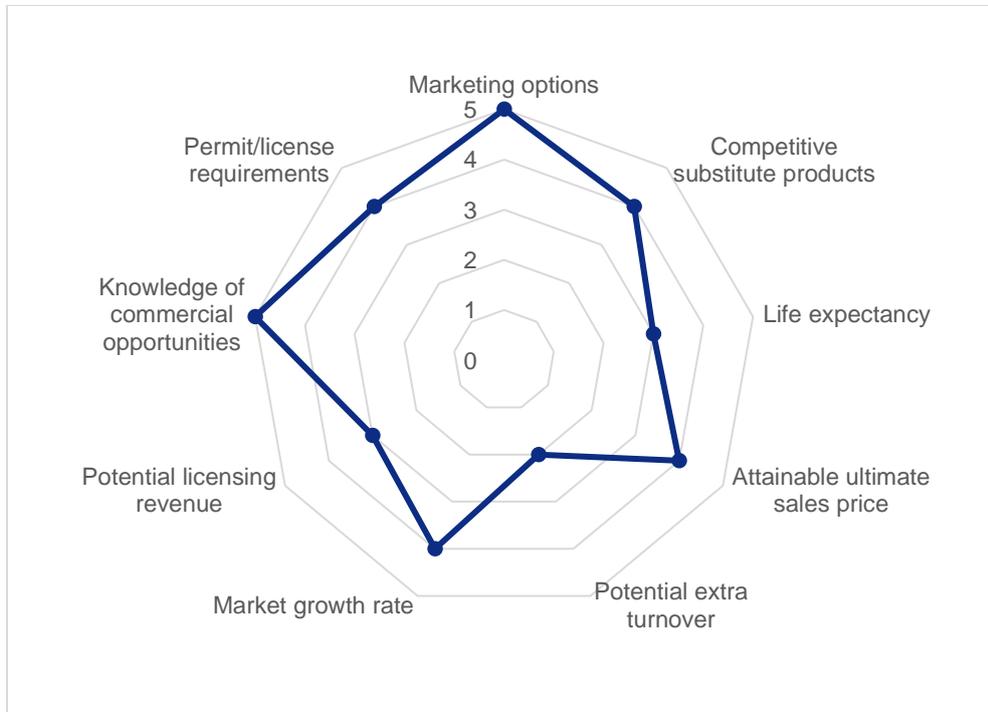
The patented technology offers improvements which can be used for marketing. Much of the arguments used in marketing do not relate specifically to the patented technology.

The technology mostly mechanical in nature and could be copied. Infringing products should be relatively easy to identify, however.

No dependencies on licences are presently known.



Market Conditions



Marketing options are excellent due to large number of markets (residential, commercial, many countries, both heating and cooling).

No similar products are presently on the market, but due to limited breadth of the patent claims it is possible that competitors over time develop substitute products falling outside the scope of present patents. The life expectancy of the patent portfolio is considered at medium level for the same reasons.

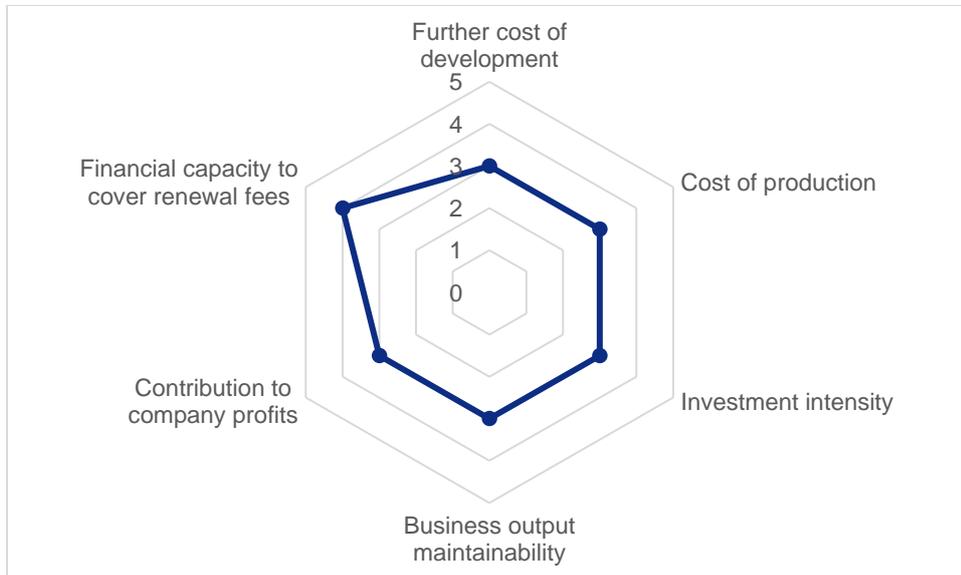
Few products offering similar energy saving are presently available, which should at least initially allow relatively high sales prices. Price on the other hand must be sufficiently low to allow a reasonably short payback time. The business model involves consulting services and manufacturing of the system. No obvious extra turnover is foreseen. The market growth rate for energy efficient HVAC systems is presently high.

Licensing of patents is relevant, but possible licensees may choose to "design-around" rather than paying for a license.

Several projects have been built or are planned, many further opportunities are viable. Innenco presently has 144 potential projects in its portfolio in mainly Europe but also Asia and USA.

Different markets may require certifications etc., but the system mainly comprises known components, so should not be a major problem.

Financial conditions



Considering the product is tested, but relatively new on the market, investments in further R&D and in particular for strengthening IP rights are to be expected. Future costs of development and investment intensity are therefore assumed to be at medium level.

Cost of production is clearly higher than known technology - typically 50-200% higher depending on configuration, but payback time is fast due to decreased energy costs as indicated in Innenco's own feasibility studies.

The patent portfolio is important for marketing and for distinguishing the system from competitors. Competitors may choose different technology however.

The patent portfolio is important to avoid larger competitors to copy product. Competitors may choose different technology however.

Renewals fees are presently small due to small and young patent portfolio but will increase rapidly once EP patent is granted.

Strategic profile



The correlation between technology and business strategy is strong - Innenco is an innovation driven business. The patent portfolio only covers parts of the system (see below), so correlation is considered only at medium level.

Patent portfolio only covers the system on a micro level (piping, distributors etc.), not on a macro level (distribution in whole buildings/communities), thus only some parts of the core-technology.

Patents are important to allow licence/sales agreements, but possible licensees may choose to "design-around" rather than paying for a license. Patent portfolio covers only specific configuration of the distributor in combination with thin piping of equal length. This may prevent competitors from patenting similar technology, but will not prevent competitors from developing similar technology with a differently configured distributor.

Innenco's freedom to operate is satisfactory (see separate section), but strong activity within the field may imply that yet unpublished patent applications surface.

Innenco's new technology is used in marketing to demonstrate the company's innovative profile. Much of the technology used in marketing is however not covered by the patent portfolio.

Patented technology improving energy efficiency plays an important part in convincing customers in new markets. Patents prevent competitors from further additions to existing systems based on patented technology, and thus secures existing markets. Competitors may choose different technology however.



Appendix C: Details regarding Legal status assessment

- 1) *What is the status of the patents?*
 - a. *Patent not yet applied for*
 - b. *Patent application filed*
 - c. *Novelty search and patentability evaluation completed*
 - d. *Patent granted*
 - e. *Opposition period expired*

A patent application involves a considerable degree of uncertainty, in terms of whether the patent will be granted after novelty search, evaluation of inventive step, and so forth. Hence a patent that has been granted gets a higher score than a patent application that has only recently been filed.

- 2) *What is the patent's legal position of strength?*
 - a. *No novelty search*
 - b. *'Quick and dirty' search (simple database search) performed*
 - c. *National office novelty search or similar*
 - d. *International novelty search*
 - e. *Novelty search and infringement search*

This factor relates to the defensibility and robustness of the patent, in disputes and legal proceedings, for example. During the different stages of the application period, it could also entail an assessment of the application's likelihood of being refused or limited. A newly-issued patent may risk subsequent revocation if opposition is filed. With more mature patents there is the possibility of legal proceedings placing the validity of the patent under close scrutiny. If patents have faced up to such attacks and withstood them, they can be considered more defensible and hence more valuable. However, oppositions and court proceedings against patents are rare. Hence the rating scale that is used places importance on what you personally can do to clarify patent defensibility in relation to existing patents, prior art and so forth.

- 3) *For how long is the patent still valid?*
 - a. *Patent has 0-2 year term remaining*
 - b. *Patent has 2-4 year term remaining*
 - c. *Patent has 4-8 year term remaining*
 - d. *Patent has 8-12 year term remaining*
 - e. *Patent has more than a 12-year term remaining*

An assessment of the stage the patent has reached in its life cycle. Is it new, mature or about to expire? Where it is possible to extend the term of the patent, as in pharmaceutical products for example, the extension must be included in the patent term remaining.

- 4) *How broad and comprehensive are the patent claims?*
 - a. *How broad and comprehensive are the patent claims?*
 - b. *The claims are quite narrow*
 - c. *The claims are reasonably broad*
 - d. *The claims are broadly inclusive*
 - e. *The claims comprise a general principle*



The breadth of a patent's claims can be a determining factor in constructing a protective shield around the essence of an invention. Also, a broad claim will enjoy a wider range of possible constructional embodiments, thus increasing the patent's scope for utilization. The broader the claims, the greater the potential value of the patent.

- 5) Does the patent's geographical coverage include the relevant markets?
- Patent protection in a single national market only*
 - Patent protection in a few market area countries*
 - Patent protection in most market area countries*
 - Patent protection in all existing market area countries*
 - Patent protection in all existing and potentially relevant market area countries*

Patents held in many countries are considered more valuable than patents offering protection in one country only. Of course, only the relevant countries are significant, i.e. countries in your own market area and your competitors' market areas, copycat countries, and countries providing raw materials or production.

- 6) Are patents monitored to identify infringements?
- No monitoring against infringement*
 - Random monitoring via reports from sales agents*
 - Some degree of systematic monitoring of selected competitor products*
 - Systematic monitoring of markets*
 - Formalized global monitoring*

This assessment factor will demonstrate the company's ability and willingness to monitor its rights. Has a formal monitoring process, of any kind, been established – or is monitoring to identify infringements more random? If patent monitoring is a more or less random affair, it will have a negative effect on the value of the patent. Granted rights are not worth much if no steps are taken to maintain them.

- 7) Are disputes and legal proceedings customary in the operative markets?
- Legal proceedings are very customary*
 - Legal proceedings exist*
 - Disputes are customary*
 - Disputes exist*
 - Disputes and legal proceedings are not customary*

A patent is valuable on an aggressive market where battles are waged. Nevertheless, disputes and legal proceedings earn a low score, as they are often demanding on company resources, while the lack of a tradition for disputes and legal proceedings earns a high score.

- 8) Does the company have the means to enforce patent rights?
- In general, too expensive and difficult to enforce patent rights*
 - Patent rights enforced in selected countries in important markets*
 - Patent rights enforced in case of selected competitors*
 - Patent rights enforced in nearly all cases if not too expensive*
 - Patent rights always enforced*

A company's resources are assessed according to its ability to take patent infringers to court. If a company does not have the financial means to prosecute rights infringement, this will have a negative effect on the value of the patent.

Appendix D: Freedom to Operate

Scope of search

As agreed with Innenco's management team, searches were conducted with respect to the below three concepts to identify potentially blocking patents:

- i) Distributor in which a variable inner volume in the direction of the flow is enabled (in accordance with claim 1 of SE 542 610)
- ii) Energy distribution system having pipe coils in two layers with a lower accumulating layer as further illustrated in figure 1.



Figure 1. Floor composition:

1. floor covering
2. piping – heating layer
3. levelling screed 15 mm
4. concrete floor
5. piping – accumulating layer
6. cement screed
7. waterproofing
8. foam glass thermal insulation (approx.200 mm)

Operating temperatures: 26 – 34°C

Reaction time of floor: 15 - 60 minutes

- iii) Control unit for (even) temperature distribution in one or several premises.



Figure 7. Stainless steel central station

The searches were delimited to the main IPC classes corresponding to the Innenco patent publications which were classified in the following classes: F24D3/10, F24D3/12, and F28F9/02. In addition, the main class F17C2227 was searched.



Limitation to the following main IPC classes was thus made:

F17C2227	Transfer of fluids; heat exchange with fluid (about 8000 documents)
F24D	Domestic or space heating systems (about 150,000 documents)
F28F	Details of heat-exchange/transfer apparatuses (200,000 documents)

Limitation was further made to patent publications filed between 2001-2021 to exclude expired patents older than 20 years no longer in force. About 3300 hits in total were screened from the generally broad searches out of which 25 are listed below as representing most similar solutions (see attached *Search Strategy* below).

FTO opinion

None of the patent positions 1-25 listed in the result section is considered to block activities according to concepts i-iii). This thus means *concept freedom/product freedom* according to the freedom-to-operate graded scale of the report (cf. point 2.2.1) would be fulfilled.

However, it is to be noted patent applications are normally published 18 months after filing. Thus, there could possibly be more relevant patent applications pending which are not yet public. Likewise, as no search is complete, the opinion herein is no guarantee further patent positions of relevance may exist.

Concept i) as implemented in granted Swedish patent SE 542 610 further appears to involve a low business risk based on the additional fact that it relies on a well-known principle – the behaviour of a fluid in a pipe (distributor) connected to channels. Several patent positions including positions 1, 3, 4, and 5 illustrate embodiments in which the cross section of a conduit is varied in the flow direction to provide uniform distribution in a system. As discussed in the result section, none of these documents are considered to block concept i).

Concept ii) is likewise considered to be exposed to a low risk based on the documents retrieved during the search. The most relevant patent position 11 was published in 2002 (now expired) which may have rendered it difficult for third parties to patent similar concepts based on heat coils in two layers.

In view of concept iii), it is recommended further searches are performed should any more specific embodiments be commercialized/developed since a great number of patents have been filed in this field which potentially may block certain commercial control circuits being developed. Various concepts based on expired technology such as patent position 24 (older than 20 years) may, however, be relied on to a certain extent as a defense against subsequent patents claiming more specific concepts.

A general note is further that most of the patent positions are filed only in China and Korea (12 out of the 25 positions). This means thus a less crowded field in the remaining markets.

In the following result section, where relevant, representative independent claims are listed in addition to the abstract not always being representative of initial/final scope of the various family members of the patent positions.



1) Family number: 30941109 (US2007062592 AA)

Title: MANIFOLD COMPRISING A BODY WITH A CONICAL INNER SURFACE SUCH THAT THE CROSS-SECTIONAL AREA DECREASES IN THE DIRECTION OF FLOW

Priority: FI20030000329 20030303 WO2004FI00112 20040302 EP20040716255 20040302

Family:	Publication number	Publication date	Application number	Application date
	AT467794 E	20100515	AT20040716255T	20040302
	CA2516072 AA	20050812	CA20042516072	20040302
	CA2516072 C	20111122	CA20042516072	20040302
	DE602004027119 D1	20100624	DE200460027119T	20040302
	DK1599692 T3	20100802	DK20040716255T	20040302
	EA007875 B1	20070227	EA20050001180	20040302
	EA200501180 A1	20060224	EA20050001180	20040302
	EP1599692 A1	20051130	EP20040716255	20040302
	EP1599692 B1	20100512	EP20040716255	20040302
	ES2343629 T3	20100805	ES20040716255T	20040302
	FI115852 B	20050729	FI20030000329	20030303
	FI20030329 A	20040904	FI20030000329	20030303
	FI20030329 A0	20030303	FI20030000329	20030303
	NO20054454 A	20050926	NO20050004454	20050926
	NO20054454 L	20050926	NO20050004454	20050926
	PL1599692 T3	20101029	PL20040716255T	20040302
	PT1599692 T	20100701	PT20040716255T	20040302
	US2007062592 AA	20070322	US20040547952	20040302
	US7726698 BB	20100601	US20040547952	20040302
	WO04079250 A1	20040916	WO2004FI00112	20040302

Probable Assignee: UPONOR INNOVATION AB

Assignee(s):(std): HAUKI PETER J ; LARSSON THOMAS ; SMAHL JARMO ; UPONOR INNOVATION AB

Inventor(s):(std): HAUKI PETER ; HAUKI PETER J ; LARSSON THOMAS ; SMAHL JARMO

Inventor(s): JARMO SMAHL ; THOMAS LARSSON

Agent(s): CASSAN MACLEAN; FISH AND RICHARDSON PC; HUHTANEN OSSI JAAKKO; OCCHIUTI TOHLICEK AND TSAO LLP

Designated states: AE AG AL AM AT AU AZ BA BB BE BF BG BJ BR BW BY BZ CA CF CG CH CI CM CN CO CR CU CY CZ DE DK DM DZ EC EE EG ES FI FR GA GB GD GE GH GM GN GQ GR GW HR HU ID IE IL IN IS IT JP KE KG KP KR KZ LC LI LK LR LS LT LU LV MA MC MD MG MK ML MN MR MW MX MZ NA NE NI NL NO NZ OM PG PH PL PT RO RU SC SD SE SG SI SK SL SN SY SZ TD TG TJ TM TN TR TT TZ UA UG US UZ VC VN YU ZA ZM ZW

International class (IPC 8-9): [F15C1/00](#) [F15C1/08](#) [F16L41/00](#) [F16L41/02](#) [F16L41/03](#) [F16L47/00](#) [F16L47/32](#) [F24D3/10](#)

International class (IPC 1-7): [F16L](#) [F16L41/02](#) [F16L41/03](#) [F16L47/32](#) [F24D3/10](#)

CPC: [F16L41/03](#) [F16L47/32](#) [F24D3/1066](#) [Y10T137/224](#)

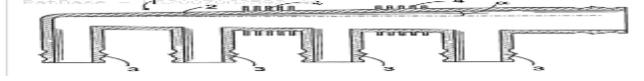
US class: [137/836](#) [285/125.1](#) [285/129.1](#)

[Classification Explorer](#)



Abstract:

A manifold (1) comprises a body (2) with a plurality of branch fittings (3) diverging therefrom. The inner surface of the body (2) is conical such that the inner cross-sectional area of the body (2) decreases in the direction of flow. The manifold (1) is particularly well suited for use in tap water systems. The manifold (1) can be manufactured e.g. from polyphenyl sulfone PPSU, polysulphone PSU, polyvinylidene fluoride PVDF, glass fibre reinforced polyamide PA, or cross-linked polyolefin plastic.



Claim 1 of [US7726698 BB](#) (in force) reads

1. A manifold comprising a body with a plurality of branch fittings diverging therefrom, wherein the inner surface of the body is conical such that the inner cross-sectional area of the body decreases in the direction of flow, and the manifold comprises ribs around the body, the ribs having outer diameters equal in size irrespective of the inner diameter of the body.

Groth comments:

With respect to concept i), it is understood the inner surface does not form a conical shape, for example by provision of a configuration of several rail members. Nor is it understood the body of the manifold (distributor) of concept i) will be provided with ribs (cf. claim 1 above) around the body having outer diameters equal in size irrespective of the inner diameter of the body.

Of these reasons, it is interpreted patent position 1 will not block concept i).

2) Family number: 67545602 (CN107366954 A)

© PatBase

Title:	HEATING CONTROL SYSTEM AND HEATING SYSTEM			
Priority:	CN201710794624	20170906	CN201721134432U	20170906
Family:	Publication number	Publication date	Application number	Application date
	CN107366954 A	20171121	CN201710794624	20170906
	CN207365179 U	20180515	CN201721134432U	20170906

Probable Assignee: AIMOSHEN ELECTRICAL TECH CO LTD

Assignee(s):(std): AIMOSHEN ELECTRICAL TECH CO LTD ; TIANJIN AIMOSHEN ELECTRIC TECH CO LTD

Assignee(s): AIMOSHEN ELECTRICAL TECHNOLOGY CO ; EMERSON ELECTRIC CO LTD IN TIANJIN ; TIANJIN AIMOSHEN ELECTRIC TECHNOLOGY CO

Inventor(s):(std): LIU JUN ; WU SHICHAO ; XU JIA

International class [F24D19/10](#) [F24D3/14](#)
(IPC 8-9):

CPC: [F24D19/1015](#) [F24D2220/042](#) [F24D3/14](#)

[Classification](#)

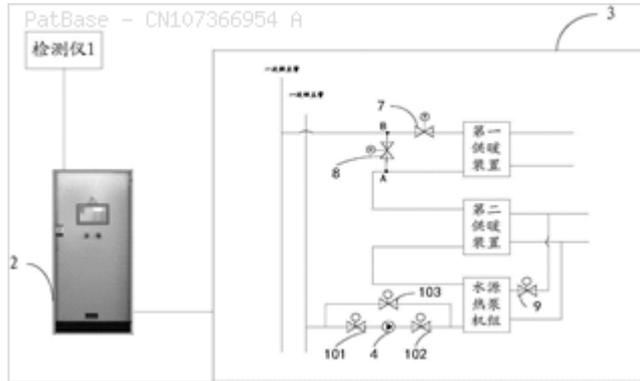
[Explorer](#)

Cited documents: JP11337091, CN207365179 U, CN204388219 U, CN106765434 A, CN104976680 A,

Forward Citations: CN107366954 A,

Abstract:

The invention provides a heating control system and a heating system and relates to the technical field of heating. The heating control system comprises a control valve, a detector and a controller, wherein the detector is arranged in an outdoor environment in a heating area of a target heat exchange station and is used for detecting the environmental parameter information in the heating area; the environmental parameter information is used for confirming a required value of heating volume of the heating area; the control valve is arranged on a water pipeline of the target heat exchange station; the control valve is used for controlling a water conveying condition in the water pipeline in real time; the controller is respectively connected with the detector and the control valve; the controller is used for receiving the environmental parameter information and controlling the switching state of the control valve on the basis of the environmental parameter information so as to control the heating condition of the target heat exchange station. The invention can relieve the technical problem of unreasonable heating in the traditional heating system.



Groth comment

This position is still valid in China. Concept iii), however, is not described to contain all features of this position. For example, patent position 2 is restricted to inter alia a

“control valve disposed on the pipeline on the target heat exchange station, wherein said control valve for real-time control of the output water pipe water situation...and a controller connected to said detector and said control valve connected to said controller for receiving said environmental parameter information based on an environmental parameter information to control the switching state of the control valve in order to control the target heat exchange station heating situation.”

Concept iii) is thus interpreted to concern a system outside the scope of patent position 2.

3) Family number: 41818269 (US2010282454 AA) © PatBase

Title:	MINICHANNEL HEAT EXCHANGER HEADER INSERT FOR DISTRIBUTION						
Priority:	WO2006US4390	2006111	EP2006083739	2006111	US2006051378	2006111	
	3	3	4	3	7	3	
Family:	Publication number	Publication date	Application number	Application date			
	CN101568792 A	20091028	CN200680056368	20061113			
	CN101568792 B	20110803	CN200680056368	20061113			
	DE602006041912 D1	20140724	DE200660041912T	20061113			
	EP2082181 A1	20090729	EP20060837394	20061113			
	EP2082181 A4	20130403	EP20060837394	20061113			
	EP2082181 B1	20140611	EP20060837394	20061113			



<u>ES2480015 T3</u>	20140725	ES20060837394T	20061113
<u>HK1138637 A1</u>	20100827	HK20100103971	20100422
<u>HK1138637 B</u>	20120601	HK20100103971	20100422
<u>US2010282454 AA</u>	20101111	US20060513787	20061113
<u>US8171987 BB</u>	20120508	US20060513787	20061113
<u>WO08060270 A1</u>	20080522	WO2006US43903	20061113

Probable Assignee: CARRIER CORP

Assignee:

Assignee(s):(std): CARRIER CORP ; JIANG YIRONG ; MUNOZ JULES R ; PARK YOUNG K ; VERMA PARMESH

Assignee(s): CARRIER CORP FARMINGTON

Inventor(s):(std): JIANG YIRONG ; MUNOZ JULES R ; PARK YOUNG K ; PARMESH VERMA ; VERMA PARMESH ; YIRONG JIANG

Inventor(s): JIANG YIRONG ELLINGTON ; MUNOZ JULES R SOUTH WINDSOR ; PARK YOUNG K SIMSBURY ; VERMA PARMESH MANCHESTER

Agent(s): BIGELOW DANA F; CANTOR COLBURN LLP; CHINA PATENT AGENT HK LTD; DE ELZABURU ALBERTO; KSNH PATENTANWALTE KLUNKER SCHMITT NILSON HIRSCH; MARJAMA MULDOON BLASIAK AND SULLIVAN LLP; TAYLOR ADAM DAVID

Designated states: AE AG AL AM AT AU AZ BA BB BE BF BG BJ BR BW BY BZ CA CF CG CH CI CM CN CO CR CU CY CZ DE DK DM DZ EC EE EG ES FI FR GA GB GD GE GH GM GN GQ GR GT GW HN HR HU ID IE IL IN IS IT JP KE KG KM KN KP KR KZ LA LC LI LK LR LS LT LU LV LY MA MC MD MG MK ML MN MR MW MX MY MZ NA NE NG NI NL NO NZ OM PG PH PL PT RO RS RU SC SD SE SG SI SK SL SM SN SV SY SZ TD TG TJ TM TN TR TT TZ UA UG US UZ VC VN ZA ZM ZW

International class F25B F25B39/02 F28D1/053 F28F F28F9/02 F28F9/22
(IPC 8-9):

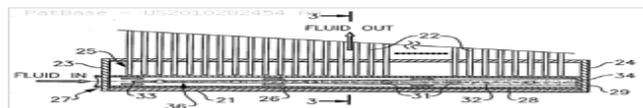
CPC: F25B39/028 F28D1/05366 F28D2021/0071 F28F9/0273

US class: 165/174 165/175 62/504

[Classification Explorer](#)

Abstract:

An inlet header of a microchannel heat exchanger is provided with a first insert disposed within the inlet header and extending substantially the length thereof, and having a plurality of openings for the flow of refrigerant into the internal confines of the inlet header and then to the channels. A second insert, disposed within the first insert, extends substantially the length of the first insert and is of increasing cross sectional area toward its downstream end such that annular cavity is formed between the first and second insert. The annular cavity of decreasing cross sectional area provides for the maintenance of a substantially constant mass flux of the refrigerant along the length of the annulus so as to thereby maintain an annular flow regime of the liquid and thereby promote uniform flow distribution to the channels.



Groth comment

It is noted claim 1 of granted EP patent (in force in Spain) covers an embodiment in which a second insert (32) is disposed within a first insert (26) and extending substantially the length of said first insert (26), said second insert (32) being of increasing cross sectional area and defining, with said first insert (26), an annulus of decreasing area as it extends away from said inlet opening (27).



It is understood concept i) will not include embodiments forming an annulus with a first and second insert. Therefore, concept i) is not considered to be blocked by this position.

4) Family number: 58214975 (CN104266531 A) © PatBase

Title: MULTICHANNEL STRUCTURE USING METAL FOAM TO UNIFORMLY DISTRIBUTE FLUID FLOW

Priority: CN201410528052 20141009

Family:	Publication number	Publication date	Application number	Application date
	CN104266531 A	20150107	CN201410528052	20141009
	CN104266531 B	20160629	CN201410528052	20141009

Probable Assignee: UNIV CHINA PETROLEUM

Assignee(s):(std): SHANGHAI JIAO TONG UNIV ; UNIV CHINA PETROLEUM

Assignee(s): CHINA UNIV OF PETROLEUM ; CHINA UNIV OF PETROLEUM EAST CHINA

Inventor(s):(std): XU HUIJIN ; XU ZHIGUO ; ZHAO CHANGYING

International class [F28F9/22](#)

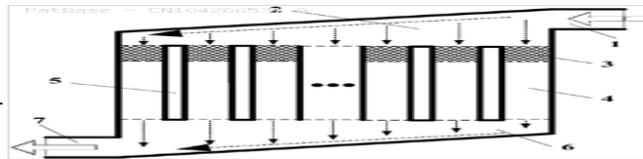
(IPC 8-9):

[Classification](#)

[Explorer](#)

Abstract:

The invention discloses a multichannel structure using metal foam to uniformly distribute fluid flow and relates to a multichannel structure for a heat exchanger. The multichannel structure using the



metal foam to uniformly distribute the fluid flow aims at solving the problem that the flowing between multiple channels is not uniform in the existing heat exchanger. The multichannel structure using the metal foam to uniformly distribute the fluid flow comprises a flow channel inlet, a distribution end, a main channel, a convergence end and a flow channel outlet which are sequentially communicated; a plurality of channel intervals are arranged inside the main channel to separate the main channel into a plurality of sub-channels; the front end of every sub-channel is full of metal foam section which is formed by metal foam; the sub-channel portions which are not full of metal foam are defined to be foam-free sections. The multichannel structure using the metal foam to uniformly distribute the fluid flow is applied to the multichannel heat exchanger in the fields such as the electronic device cooling, the refrigeration low temperature technology, air separation and petrochemical engineering and guarantees the fluid flowing uniformity.

Groth comment

This position has lapsed and is no longer pending. Enclosed only as an illustration.

5) Family number: 43109813 (KR20090029992 A) © PatBase

Title: DISTRIBUTOR OF HOT WATER FOR HEATING ROOM

Priority: KR20070095240 20070919

Family:	Publication number	Publication date	Application number	Application date
	KR20090029992 A	20090324	KR20070095240	20070919



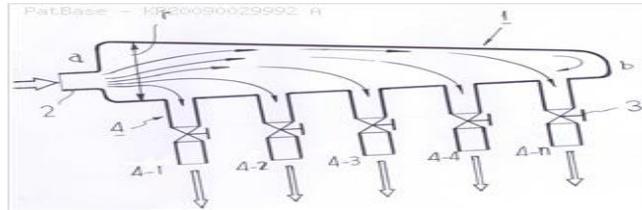
Probable Assignee: GEUMGANG HIGH TECH CO LTD
 Assignee(s):(std): GEUMGANG HIGH TECH CO LTD
 Assignee(s): GEUMGANG HIGH TECH CO
 Inventor(s):(std): JEONG WON WOO ; SON YOUNG JOON ; YEO HYOUNG KOO
 International class F24D3/10
 (IPC 8-9):
 CPC: E03C1/021 F16L41/16 F24D3/1066

Classification
Explorer

Forward Citations: WO18115193 A3,

Abstract:

A distributor of hot water for heating a room is provided to grasp the fluid condition of a hot water distribution pipe inside in outside by making the hot water distribution pipe of transparent synthetic resins. A distributor of hot water for heating a room comprises: a hot water inlet pipe(2) formed in the one side of a hot water distribution pipe(1); and a plurality of supply pipes(4-1,4-2,4-3,4-4,4-n) formed in the lower part of the hot water distribution pipe at regular intervals. The hot water inlet(a) inner diameter(r) of the hot water distribution pipe is big. The inner diameter gradually becomes smaller to the end part(b) of the hot water distribution pipe. The hot water distribution pipe is made of the transparent synthetic resins so that fluid condition of the hot water distribution pipe inside is grasped in outside.



Groth comment

This position has lapsed and is no longer pending.

6) Family number: 36069002 (JP2007198122 A2) © PatBase

Title: FLOOR HEATING APPARATUS
 Priority: JP20050377443 20051228 JP20060348251 20061225
 Family:

Publication number	Publication date	Application number	Application date
<u>JP2007198122 A2</u>	20070809	JP20060348251	20061225

Probable Assignee: YASHIMA PRODUCTS
 Assignee(s):(std): YASHIMA PRODUCTS
 Assignee(s): YASHIMA KK
 Inventor(s):(std): ASO KAZUKO ; OKUZUMI TAKAICHI ; SAKANE KYOJI
 International class E04F15/18 F24D11/00 F24D3/00 F24D3/12 F24D3/14
 (IPC 8-9):
 CPC: Y02B30/00

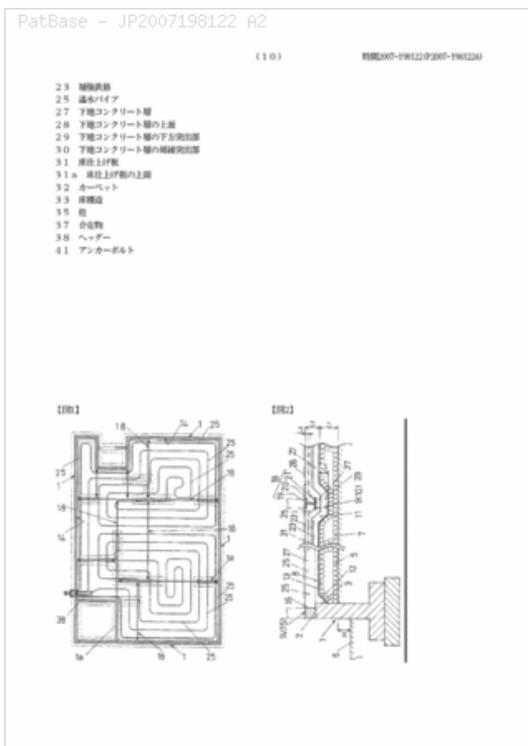
Classification
Explorer

Cited documents: JP3051723 U, JP10273948, JP2000220207 A2,
 JP2002167978 A2, JP2000192566 A2, JP2002257371 A2,
 JP2000274711 A2, JP2004271122 A2,

Abstract:

PROBLEM TO BE SOLVED: To provide a floor heating in which safety is secured by low-temperature warm water and high efficiency is ensured even during the intermittent operation. SOLUTION: A concrete continuous foundation 1 is

formed on the outer periphery (a). A stone layer 7 is formed on the inside of the continuous foundation 1 (b). A groove 9 is formed by the stone layer 7 under the position where an inner base 18 is installed. A wooden outer peripheral base 14 is fixed onto the continuous foundation 1. The H-steel inner base 18 is installed correspondingly to the position of a column. A resin film 13 is put on the upper surface of the stone layer 7. Reinforcements 23, 23 are arranged, and a hot water pipe 25 for floor heating is disposed (c). Next, a concrete is deposited on the stone layer 7 to construct a substrate concrete layer 27 in which the warm water pipe 25 is buried. Then, a floor finishing plate 31 is laid down on the substrate concrete layer 27 to construct a floor structure 33. When the warm water of 40 to 50 degrees centigrade in temperature flows in the warm water pipes, the floor heating can be performed while accumulating heat in the substrate concrete layer 27 and the stone layer 7.



Groth comment

Concept ii) is not described to comprise the features of position 6 and would thus not fall inside such scope.



7) Family number: 59712573 (CN104764085 A) © PatBase

Title: HEATING SYSTEM BASED ON CLOUD PROCESSING INTELLIGENT ADJUSTMENT
Priority: CN201510206482 20150427

Family:	Publication number	Publication date	Application number	Application date
	CN104764085 A	20150708	CN201510206482	20150427
	CN104764085 B	20160831	CN201510206482	20150427

Probable Assignee: UNIV NANYANG NORMAL
Assignee(s):(std): NANYANG NORMAL UNIV ; UNIV NANYANG NORMAL
Inventor(s):(std): BAI KUN ; CHENG NING ; HAO SHEN GANG ; LI CAIHONG ; LIU JINJIANG ; ZHANG LI
International class [F24D19/10](#)
(IPC 8-9):
CPC: [Y02B10/20](#) [Y02B10/70](#)

[Classification Explorer](#)

Cited documents: CN203785075, CN103939979, CN203785075 U, CN103939979 A,
Forward Citations: CN111442328 A, CN109140563 B, CN109140563 A, CN109282351 A,

Abstract:
The invention provides a heating system based on cloud processing intelligent adjustment. A heat exchanging system comprises a programmable logic controller. The programmable logic controller is connected with a cloud server. The cloud server is connected with a client. The programmable logic controller transmits measured data to the cloud server, then the measured data are transmitted to the heat exchanging system client through the cloud server, and the client can obtain the operation information of the heat exchanging system timely. A traditional local server is replaced by the cloud server of a monitoring system based on cloud calculation, and the heating system is convenient to maintain and high in flexibility.



Groth comment

Concept iii) is not considered to be in conflict with this position.

8) Family number: 50395332 (CN202090557 U) © PatBase

Title: Double-heating floor board heating floor tile
Priority: CN201120092724U 20111008

Family:	Publication number	Publication date	Application number	Application date
	CN202090557 U	20111228	CN201120092724U	20111008

Probable Assignee: SHUXIN LI
Assignee(s):(std): SHUXIN LI



Assignee(s): LI SHUXIN
 Inventor(s):(std): SHUXIN LI
 Inventor(s): LI SHUXIN
 International class E04F15/02 F24D11/00

(IPC 8-9):

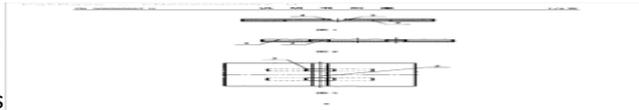
[Classification](#)

[Explorer](#)

Forward Citations: JP6595313 B2, JP2016104957 A2, CN102677862 A, CN102677862 B,

Abstract:

A double-heating floor board heating floor tile comprises a floor tile body. A heating pipe groove for containing heating pipes is arranged on the upper surface of the floor tile body, a heat storing pipe groove is arranged on the lower surface of the floor tile body and heat storing bars are arranged inside the heat storing pipe groove. The heating pipe groove is conducted with the heat storing pipe groove through a heat conducting port so that the heating pipes and the heat storing bars are connected in tightly pressing mode. The heat storing bars are arranged in the heating floor tile so that heat storage quantity of the heating floor tile is greatly increased, and accordingly heat radiation heating load toward indoors is increased, and indoor temperature increases quickly. The double-heating floor board heating floor tile radiates heat vertically and provides heat evenly, and therefore indoor temperature is comfortable.



Claim 1 reads

a double heating floor heating floor tiles, including floor tiles body, the upper body with a receiving surface heating pipe heating ducts, characterized in that the lower surface of the body has a thermal storage tube tank, the thermal storage tube Setting the heat storage tank rod; the heating ducts and the ducts through regenerative thermal conduction mouth, so that the heating tube and heat storage rod clamping connection.

Groth comment

Concept ii) is not described to involve the features of this position.

9) Family number: 80276660 (CN211172899 U)

© PatBase

Title: ELECTRIC HEATING FLOOR WITH DOUBLE-LAYER GRAPHITE HEAT CONDUCTION FILM

Priority: CN201921934007U 20191111

Family:	Publication number	Publication date	Application number	Application date
	<u>CN211172899 U</u>	20200804	CN201921934007U	20191111

Probable Assignee: ZHU HUAI ZE

Assignee(s):(std): ZHU HUAIZE

Inventor(s):(std): ZHU HUAIZE

International class E04F15/02 E04F15/10 E04F15/18 F24D13/02

(IPC 8-9):

[Classification](#)

[Explorer](#)

Abstract:

The utility model discloses an electric heating floor with a double-layer graphite heat conduction film. The device comprises a base plate, an upper thin plate located above the base plate and a lower thin plate located below the base plate. A first





graphite heat conduction film is arranged between the base plate and the upper thin plate; a second graphite heat conduction film is arranged between the base plate and the lower thin plate; the lower surface of the upper thin plate and the upper surface of the first graphite heat conduction film, the lower surface of the first graphite heat conduction film and the upper surface of the substrate, the lower surface of the substrate and the upper surface of the second graphite heat conduction film, and the lower surface of the second graphite heat conduction film and the upper surface of the lower thin plate are bonded and fixed through glue. According to the electric heating floor with the double layers of graphite heat conduction films, the two layers of graphite heat conduction films are arranged on the bottom plate, so that a good soaking effect is achieved, the uniformity of plate surface temperature distribution is greatly improved, and the heat accumulation phenomenon of the surface temperature of the electric heating floor after heating is reduced.

Groth comment

This position merely illustrates two layered conduction (double-layer graphite) in analogy with concept ii) but has no blocking effect.

10) Family number: 30438439 (KR20030030483 A)

© PatBase

Title: INDOOR TEMPERATURE CONTROL SYSTEM OF ACCUMULATION ELECTRIC ONDOL USING ELECTRIC HEAT RESISTANCE

Priority: KR20010062643 20011011

Family:	Publication number	Publication date	Application number	Application date
	KR100411814 B1	20031224	KR20010062643	20011011
	KR20030030483 A	20030418	KR20010062643	20011011

Probable Assignee: KOREA ELECTRIC POWER CORP

Assignee(s):(std): KOREA ELECTRIC POWER CORP

Inventor(s):(std): LEE GYEONG HO ; LEE SANG YEOL

International class [F24D15/00](#) [F24D15/02](#)

(IPC 8-9):

International class [F24D15/02](#)

(IPC 1-7):

CPC: [F24D13/024](#) [F24D15/02](#) [F24D19/1015](#) [F24D2200/08](#) [F24D2220/0207](#)
[F24D2220/0271](#) [F24D2220/042](#) [F24D2220/08](#) [F24D2220/10](#) [Y02B30/12](#)

[Classification](#)

[Explorer](#)

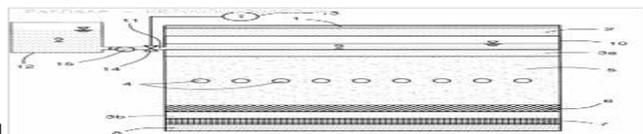
Cited documents: JP63198922 U1, JP59095322 A2, KR900000657 A, KR20030030482 A, JP63054530 A2, KR200234400 Y1, JP7026607 U,

Forward Citations: CN105352015 A,

Abstract:

PURPOSE: An indoor temperature control system is provided to constantly maintain the indoor temperature set by a user, while improving utilization of accumulated heat.

CONSTITUTION: An indoor temperature control system comprises a heat radiation layer(2), an upper heat insulating layer(3a), a heat accumulating material(5) equipped with an electric heater(4); a lower heat insulating layer(3b); a damp course(7); a bottom layer(8); an electric heat resistance space layer(10) formed between the heat radiation layer and the upper heat insulating layer, and filled with a water(9), wherein the electric heat resistance space layer is connected to a water storage tank(12) through a pipe(11) which is equipped with a pump(15) for supply and recovery of the water; and an automatic valve(14) mounted on the pipe, which opens/shuts by a temperature sensor(13).





Groth comment

Position 10 illustrates a control system for constantly maintaining the indoor temperature set by a user while improving utilization of accumulated heat. Concept iii) is not described to involve the combination of elements making up this system.

11) Family number: 23485014 (DE20102863 U1)

© PatBase

Title: UNDER-FLOOR HEATING

Priority: DE20012002863U 20010219

Family:	Publication number	Publication date	Application number	Application date
	<u>DE20102863 U1</u>	20020801	DE20012002863U	20010219

Probable Assignee: U S H INNOVATIONEN GMBH

Assignee(s):(std): U S H INNOVATIONEN GMBH

International class F24D3/12

(IPC 8-9):

International class E04F15/12 F24D3/14

(IPC 1-7):

CPC: F24D3/14 Y02B30/00

Classification

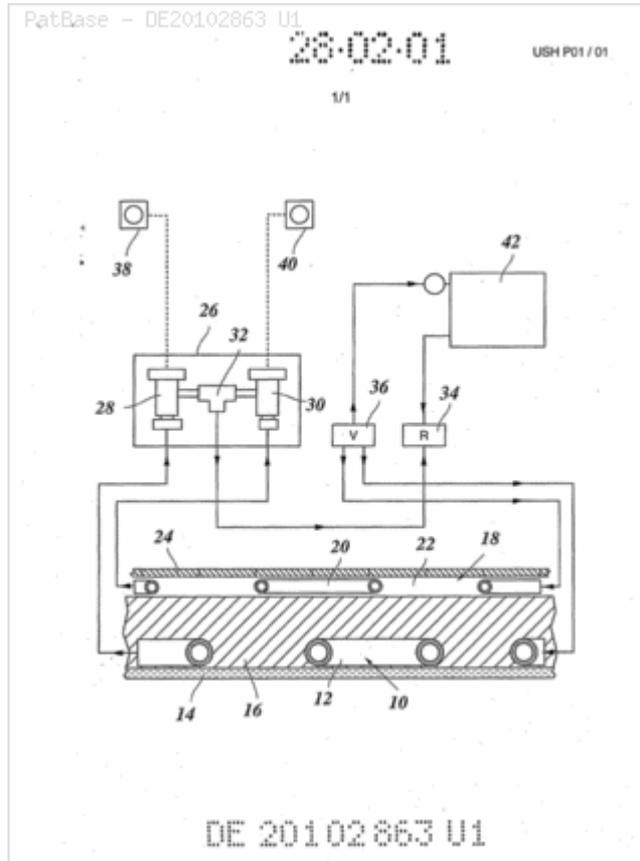
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Forward Citations: CN103528112 A,

DE102017003025 A1



Abstract:
 Source: DE20102863 U1 Machine translation: (Claim 1) 1. Under-floor heating, is characterised by two layers arranged one above the other (10, 18) of heating coils (12, 20).



Groth comment

This position (abandoned) exemplifies provision of heat coils in two layers corresponding to concept ii). This position was published in 2002. It would thus not be possible to obtain a valid patent based on these features as such. As concept ii) does not appear to involve any further patentable matter, it is unlikely a corresponding scope would have been obtained subsequent to the publication of position 11.

12) Family number: 33542746 (AU2003286855 AA) © PatBase

Title:	METHOD AND APPARATUS FOR ACHIEVING TEMPERATURE UNIFORMITY AND HOT SPOT COOLING IN A HEAT PRODUCING DEVICE			
Priority:	US20020423009 P 1	2002110 P 4	US20030442383 P 4	2003012 P 7
	US20030462245 P 1	2003041 P 4	WO2003US3487 P 4	2003103 P 0
Family:	Publication number	Publication date	Application number	Application date
	AU2003286855 AA	20040607	AU20030286855	20031030
	AU2003286855 AH	20040607	AU20030286855	20031030
	DE10393618 T5	20051117	DE20031093618T	20031030
	JP2006516068 T2	20060615	JP20050502253T	20031030



Probable Assignee: COOLIGY INC

Assignee: COOLIGY INC

Inventor(s):(std): GOODSON KENNETH ; HOM JAMES ; KENNY THOMAS ; MCMASTER MARK ; MUNCH MARK ; UPADHYA GIRISH ; ZHOU PENG

Inventor(s): GIRISH UPADHYA ; JAMES HOM ; KENNETH GOODSON ; MARK MCMASTER ; MARK MUNCH ; PENG ZHOU ; THOMAS KENNY

Agent(s): IGA SEIJI; KOIKE AKIRA; TAMURA EIICHI

Designated states: AE AG AL AM AT AU AZ BA BB BE BF BG BJ BR BW BY BZ CA CF CG CH CI CM CN CO CR CU CY CZ DE DK DM DZ EC EE ES FI FR GA GB GD GE GH GM GN GQ GR GW HR HU ID IE IL IN IS IT JP KE KG KP KR KZ LC LK LR LS LT LU LV MA MC MD MG MK ML MN MR MW MX MZ NE NI NL NO NZ OM PG PH PL PT RO RU SC SD SE SG SI SK SL SN SY SZ TD TG TJ TM TN TR TT TZ UA UG UZ VC VN YU ZA ZM ZW

International class (IPC 8-9): [B21D53/02](#) [F04B19/00](#) [F28F13/18](#) [F28F19/02](#) [F28F7/00](#) [G05D23/00](#) [H01L23/427](#) [H01L23/473](#)

International class (IPC 1-7): [B21D53/02](#) [F28F13/18](#) [F28F19/02](#) [F28F27/00](#) [F28F3/04](#) [F28F7/00](#) [G05D23/00](#)

CPC: [F04B19/006](#) [F28D15/00](#) [F28F2260/02](#) [F28F3/048](#) [F28F3/12](#) [H01L23/427](#) [H01L23/473](#) [H01L2924/0002](#) [Y10T29/4935](#)

Classification Explorer

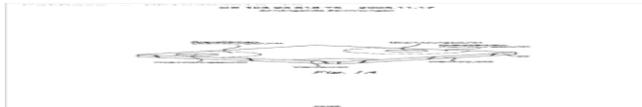
Forward Citations: KR20200046216 A, KR102170654 B1, JP2015061076 A2, US9817453 BB, JP2008502137 T2, JP2006086503 A2, JP2006054434 A2, JP2006049861 A2,

DE102014113390 A1

DE102006050256 A1

Abstract:

A method of controlling temperature of a heat source in contact with a heat exchanging surface of a heat exchanger, wherein the heat exchanging surface is substantially aligned along a plane. The method comprises channeling a first temperature fluid to the heat exchanging surface, wherein the first temperature fluid undergoes thermal exchange with the heat source along the heat exchanging surface. The method comprises channeling a second temperature fluid from the heat exchange surface, wherein fluid is channeled to minimize temperature differences along the heat source. The temperature differences are minimized by optimizing and controlling the fluidic and thermal resistances in the heat exchanger. The resistances to the fluid are influenced by size, volume and surface area of heat transferring features, multiple pumps, fixed and variable valves and flow impedance elements in the fluid path, pressure and flow rate control of the fluid, and other factors.



Groth comment

Position 12 is abandoned in all states.

13) Family number: 57423344 (US2014262186 AA) © PatBase

Title:	HEAT TRANSFER SYSTEM AND METHOD INCORPORATING TAPERED FLOW FIELD					
Priority:	US20130782458	2013031	EP2014076749	2014031	WO2014US2724	2014031
	P	4	5	4	6	4
	US20140210616	2014031	US2018001892	2018062		
	4	7		6		

Family:	Publication number	Publication date	Application number	Application date
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DE602014069416 D1	20200917	DE201460069416T	20140314
EP2974576 A1	20160120	EP20140767495	20140314
EP2974576 A4	20161019	EP20140767495	20140314
EP2974576 B1	20200826	EP20140767495	20140314
US10018430 BB	20180710	US20140210616	20140314
US2014262186 AA	20140918	US20140210616	20140314
US2018306531 AA	20181025	US20180018927	20180626
WO14152354 A1	20140925	WO2014US27246	20140314

Probable Assignee: ROCHESTER INST OF TECHNOLOGY

Assignee:

Assignee(s):(std): KANDLIKAR SATISH G ; ROCHESTER INST OF TECH ; ROCHESTER INST TECH

Assignee(s): ROCHESTER INST OF TECHNOLOGY ; ROCHESTER INST OF TECHNOLOGY
ROCHESTER

Inventor(s):(std): KANDLIKAR SATISH G

Inventor(s): KANDLIKAR SATISH

Agent(s): ADAMSON JONES; BOND SCHOENECK AND KING PLLC; GULDE AND PARTNER
PATENT U RECHTSANWALTSKANZLEI MBB; JOSEPH; NOTO JOSEPH M

Designated states:

AE AG AL AM AO AT AU AZ BA BB BE BF BG BH BJ BN BR BW BY BZ CA CF CG CH
CI CL CM CN CO CR CU CY CZ DE DK DM DO DZ EC EE EG ES FI FR GA GB GD GE
GH GM GN GQ GR GT GW HN HR HU ID IE IL IN IR IS IT JP KE KG KM KN KP KR KZ
LA LC LI LK LR LS LT LU LV LY MA MC MD ME MG MK ML MN MR MT MW MX MY MZ
NA NE NG NI NL NO NZ OM PA PE PG PH PL PT QA RO RS RU RW SA SC SD SE SG
SI SK SL SM SN ST SV SY SZ TD TG TH TJ TM TN TR TT TZ UA UG US UZ VC VN ZA
ZM ZW

International class (IPC 8-9): [F25D15/00](#) [F28D21/00](#) [F28F1/02](#) [F28F13/08](#) [F28F3/02](#) [H01L23/34](#) [H01L23/367](#)
[H01L23/427](#) [H01L23/473](#) [H05K7/20](#)

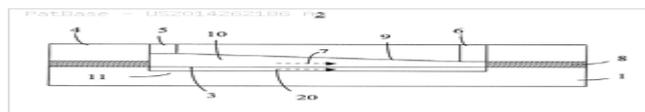
CPC: [F28D2021/0028](#) [F28F13/08](#) [F28F3/02](#) [H01L23/3672](#) [H01L23/427](#) [H01L23/473](#)
[H01L2924/0002](#) [H01L2924/00](#)

US class: [1/1](#) [165/177](#)

[Classification Explorer](#)

Abstract:

A heat transfer system including a fluid inlet; a fluid outlet; and a substrate in fluid communication with the fluid inlet and fluid outlet, the substrate including a heat



exchange region having a heat transfer surface and a flow field adjacent the heat transfer surface, the flow field including a fluid flow area including an open region at the inlet, a heat transfer region in thermal communication with the heat exchange region, and a taper of the flow field cross-sectional area in the flow direction, wherein the flow field heat transfer region includes a plurality of spaced apart open enhancement features from 1 micron to 3 mm in size, and method for enhancing the heat transfer performance of an apparatus is disclosed.

Groth comment

This position involves a taper of the flow field cross-sectional area in the flow direction with flow field heat transfer region including a plurality of spaced apart open enhancement features from 1 micron to 3 mm in size. No corresponding features are involved in concept i). Concept i) is thus outside the scope of position 13.

14) Family number: 78910940 (CN111156587 A)

© PatBase

Title: HEAT EXCHANGE STATION CONTROL SYSTEM AND ROOM TEMPERATURE CHARACTERISTIC CURVE MODEL AI ALGORITHM

Priority: CN201911007188 20191022

Publication number	Publication date	Application number	Application date
CN111156587 A	20200515	CN201911007188	20191022

Probable Assignee: RUNA SMART EQUIP CO LTD

Assignee(s):(std): RUNA SMART EQUIP CO LTD ; RUNA SMART EQUIPMENT CO LTD

Assignee(s): DARUNAVIR INTELLIGENT EQUIPMENT CO LTD ; RUNA SMART EQUIPMENT CO

Inventor(s):(std): TANG BAOHONG ; ZHANG SHIYU

International class [F24D19/10](#) [G06Q10/06](#) [G06Q50/06](#)

(IPC 8-9):

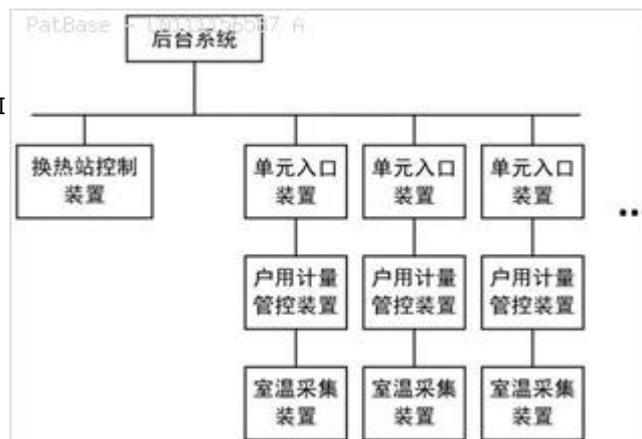
CPC: [F24D19/1006](#) [G06Q10/067](#) [G06Q50/06](#)

[Classification Explorer](#)

Cited documents: CN109631150 A, CN109165418 A, EP3376122 A1, CN108105844 A, KR20180047683 A, CN104048347 A, CN103017253 A, CN102927619 A, CN101976426 A,

Abstract:

The invention provides a heat exchange station control system and a room temperature characteristic curve model AI algorithm. The heat exchange station control system comprises a background system, a heat exchange station control device and at least one group of two-network equipment, wherein the heat exchange station control device and the two-network equipment are connected with the background system through the network in a wireless mode. The two-network equipment comprises a unit inlet device, a household metering control device and a room temperature acquisition device which are connected in sequence through the network. According to the heat exchange station control system and the room temperature characteristic curve model AI algorithm, the heat exchange station control system and the two-network equipment are integrated into a whole through the wireless networking mode, so that the overall linkage adjustment from the heat exchange station to a heat user is realized; and meanwhile, the room temperature curve model AI algorithm is used for automatically generating the temperature and the flow suitable for the area, and no heat load calculation formula needs to be provided, so that the system is more scientific and intelligent, energy is saved, the consumption is reduced, and the overall heat supply quality is improved.



Claim 1 reads

A heat station control system, characterized in that includes a backend systems, and through a wireless network connection with the backend systems Heat station control device and at least one group of second network device, the second network device, the network connection unit comprises sequentially through the inlet means, household metering tube control device and room temperature acquisition device.

Groth comment



Concept iii) is not described to comprise all features of position 14. This recently filed patent application is pending and not yet granted.

15) Family number: 30438438 (KR20030030482 A) © PatBase

Title: INDOOR TEMPERATURE CONTROL SYSTEM OF ACCUMULATION ELECTRIC ONDOL USING FLUID CONTROL

Priority: KR20010062642 20011011

Family:	Publication number	Publication date	Application number	Application date
	KR100411813 B1	20031224	KR20010062642	20011011
	KR20030030482 A	20030418	KR20010062642	20011011

Probable Assignee: KOREA ELECTRIC POWER CORP

Assignee(s):(std): KOREA ELECTRIC POWER CORP

Inventor(s):(std): LEE GYEONG HO ; LEE SANG YEOL

International class [F24D15/00](#) [F24D15/02](#)

(IPC 8-9):

International class [F24D15/02](#)

(IPC 1-7):

CPC: [F24D13/024](#) [F24D15/02](#) [F24D19/1024](#) [F24D2200/08](#) [F24D2220/0207](#)
[F24D2220/0235](#) [F24D2220/042](#) [F24D2220/10](#) [Y02B30/12](#)

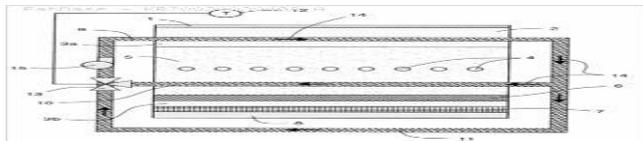
[Classification](#)

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Forward Citations: KR100411814 B1,

Abstract:

PURPOSE: An indoor temperature control system is provided to prevent excessive heat radiation during an early stage and maintain indoor temperature constant,



while improving utilization of accumulated heat. CONSTITUTION: An indoor temperature control system comprises a heat radiation layer(2), an upper heat insulating layer(3a), a heat accumulating material(5) equipped with an electric heater(4); a lower heat insulating layer(3b); a damp course(7); a bottom layer(8); a supply pipe(9) interposed between the heat radiation layer and the upper heat insulating layer, and branched off into a heat accumulating pipe(10) passing through the heat accumulating material and a bypass pipe(11) passing underneath the bottom layer; and a three-way automatic control valve(13) arranged at the confluence of the heat accumulating pipe and the bypass pipe, and connected to a temperature sensor(12).

Groth comments

Position 15 illustrates a control system for controlling indoor temperature while preventing excessive heat radiation. This position has been abandoned.

16) Family number: 23509671 (EP1235130 A2) © PatBase

Title: METHOD AND DEVICE FOR CONTROLLING THE ROOM TEMPERATURE

Priority: DE20011008847 20010223 DE20015011192T 20011224

Family:	Publication number	Publication date	Application number	Application date
	AT342536 E	20061115	AT20010130806T	20011224
	CZ20020603 A3	20021016	CZ20020000603	20020219
	DE10108847 C1	20020808	DE20011008847	20010223
	DE50111192 D1	20061123	DE20015011192T	20011224

EP1235130 A2	20020828	EP20010130806	20011224
EP1235130 A3	20050126	EP20010130806	20011224
EP1235130 B1	20061011	EP20010130806	20011224
HU0200690 AB	20020928	HU20020000690	20020222
SK200101864 A5	20020910	SK20010001864	20011214

Probable Assignee: TECHEM ENERGY SERVICES GMBH

Assignee(s):(std): TECHEM ENERGY SERVICES GMBH ; TECHEM SERVICE AG ; TECHEM SERVICE AND CO AG KG

Assignee(s): TECHEM SERVICE AKTIENGESELLSCHAFT AND CO KG

Inventor(s):(std): DR OHL JOCHEN ; OHL JOCHEN ; OHL JOCHEN DR

Designated states: AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR

International class [F24D19/00](#) [F24D19/10](#) [G05D23/00](#) [G05D23/19](#)
(IPC 8-9):

International class [F24D19/10](#) [G01K17/08](#) [G05D23/00](#) [G05D23/19](#) [G05D23/30](#)
(IPC 1-7):

CPC: [G05D23/1931](#)

[Classification](#)

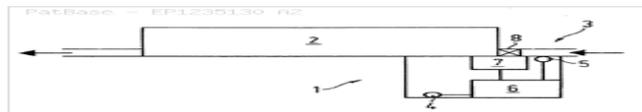
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Cited documents: GB2320966 A1, DE4022935 C1, DE3423731 A1, DE3345511 A1, DE3306574 C1, DE3136520 A1, DE19749623 A1, DE19728803 C1,

Abstract:

The method involves a first temperature sensor (4) detecting a local value for room air temperature, a second

temperature sensor (5) detecting the feed temperature of the heating medium to a heating body (2) and determining the room air temperature from the two values measured by the temperature sensors using a correction algorithm. Independent claims are also included for the following: an arrangement for implementing the method.



Claim 1 of the European patent reads

1. A method for controlling the room temperature, with a first temperature sensor (4) detecting a local room temperature value and a second temperature sensor (5) detecting the forward temperature of the heating medium supplied to a radiator (2), **characterized in that** the room temperature is determined, by means of a correction algorithm, from the temperature values measured by the two temperature sensors (4, 5).

Groth comment

With respect to this position, concept iii) does not involve a correction algorithm and the patent would thus not cover concept iii). This position appears to be granted and in force only in Austria.

17) Family number: 52160349 (CN102721107 A)

© PatBase

Title: INTERNET-OF-THINGS-BASED HEATER CONTROL SYSTEM



Priority: CN201210218879 20120629

Family:	Publication number	Publication date	Application number	Application date
	<u>CN102721107 A</u>	20121010	CN201210218879	20120629

Probable Assignee: SHAO JIANJUN

Assignee(s):(std): JUNFA MAO ; SHAO JIANJUN

Assignee(s): MAO JUNFA

Inventor(s):(std): JUNFA MAO

Inventor(s): MAO JUNFA

International class F24D19/10 H04L12/28 H04W84/18

(IPC 8-9):

CPC: Y02D30/70

Classification

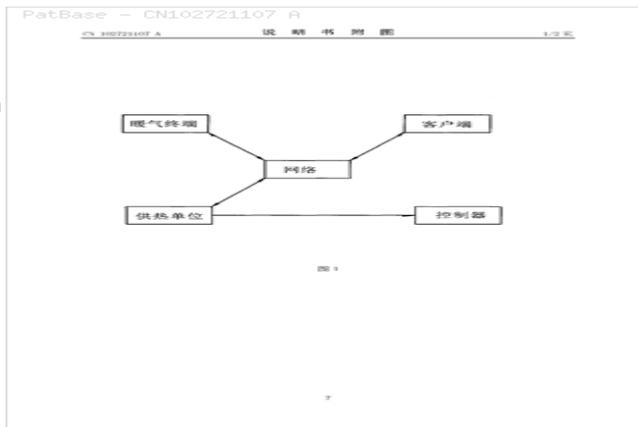
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Cited documents: US5779143 A, EP0884569 A1, EP0470935 A1, CN2655078 Y, CN201954655 U, CN201363827 Y, CN1847808 A, CN1226000 A, CN102297474 A, CN102062445 A,

Forward Citations: CN110701672 A, CN103971497 A, CN107178879 A, CN106970597 A, CN103955794 A, CN105791298 A, CN105955182 A, CN105607607 A,

Abstract:

The invention discloses an internet-of-things-based heater control system. The system comprises a heater terminal which is connected with an internet of things, a client, a server of a heating unit and a controller, wherein the heater terminal is arranged in a resident room and is used for acquiring a water temperature, flow, pressure and a room temperature in a heater pipeline in the resident room, controlling control valves in a plurality of resident rooms and transmitting the acquired water temperature, flow and room temperature information to the server of the heating unit through the internet of things; the heating unit is used for counting and summarizing the acquired information; and the controller is used for controlling a heating boiler or heat exchange equipment.



Groth comment

This is yet an illustration of an IoT-based heater control system (abandoned and no longer in force).

18) Family number: 69564365 (US2018119973 AA) © PatBase

Title: APPARATUS, SYSTEMS AND METHODS FOR SMART AIR SIGNATURE DETECTION AND MANAGEMENT BASED ON INTERNET-OF-THINGS TECHNOLOGY

Priority: US20160414049P 20161028 US20170796544 20171027

Family:	Publication number	Publication date	Application number	Application date
	<u>US2018119973 AA</u>	20180503	US20170796544	20171027
	<u>WO18081611 A1</u>	20180503	WO2017US58830	20171027



Probable Assignee: FUTUREAIR INC

Assignee(s):(std): FUTUREAIR INC ; ROTHMAN SIMONE ; SHIMADA JUN ; WANG MICHAEL

Inventor(s):(std): ROTHMAN SIMONE ; SHIMADA JUN ; WANG MICHAEL

Agent(s): YANG CINDY

Designated states: AE AG AL AM AO AT AU AZ BA BB BE BF BG BH BJ BN BR BW BY BZ CA CF CG CH CI CL CM CN CO CR CU CY CZ DE DJ DK DM DO DZ EC EE EG ES FI FR GA GB GD GE GH GM GN GQ GR GT GW HN HR HU ID IE IL IN IR IS IT JO JP KE KG KH KM KN KP KR KW KZ LA LC LK LR LS LT LU LV LY MA MC MD ME MG MK ML MN MR MT MW MX MY MZ NA NE NG NI NL NO NZ OM PA PE PG PH PL PT QA RO RS RU RW SA SC SD SE SG SI SK SL SM SN ST SV SY SZ TD TG TH TJ TM TN TR TT TZ UA UG US UZ VC VN ZA ZM ZW

International class F24D19/10 F24F11/00 F24F3/14 G05B15/02 H04L29/08 H04W4/00
(IPC 8-9):

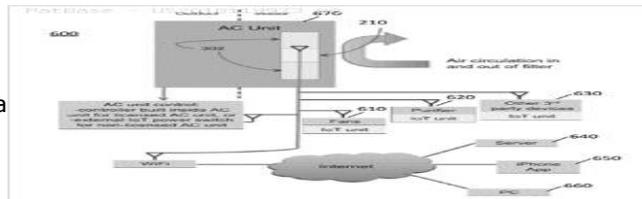
CPC: F24F11/30 F24F11/58 F24F11/62 F24F11/64 F24F2110/10 F24F2110/20
F24F2110/30 F24F2110/40 F24F2110/50 F24F2110/62 F24F2110/64
F24F2110/65 F24F2110/66 F24F2110/70 F24F2110/72 G05B15/02
G05B2219/2614 Y02B30/70

US class: 1/1 700/276

Classification Explorer

Abstract:

Apparatus, systems and methods for smart air signature detection and management in at least one room within a building are disclosed herein. In one embodiment, an apparatus for monitoring, reporting and modifying the air in at least one room with at least one entrance/exit door within a building is disclosed. The apparatus comprises a plurality of sensors configured for sensing information related to a plurality of characteristics of the air in at least one room; a processor configured for collecting and processing the information to generate air-related data; and a transceiver configured for communicating the air-related data to a user device of a user and configured for communicating with a network of one or more devices that can modify the air in the at least one room. Systems and methods related thereto are disclosed herein.



Apparatus, systems and methods for smart air signature detection and management in at least one room within a building are disclosed herein. In one embodiment, an apparatus for monitoring, reporting and modifying the air in at least one room with at least one entrance/exit door within a building is disclosed. The apparatus comprises a plurality of sensors configured for sensing information related to a plurality of characteristics of the air in at least one room; a processor configured for collecting and processing the information to generate air-related data; and a transceiver configured for communicating the air-related data to a user device of a user and configured for communicating with a network of one or more devices that can modify the air in the at least one room. Systems and methods related thereto are disclosed herein.

Claim 1 of this position (still pending application) reads

1. An apparatus for monitoring, reporting and modifying the air in at least one room within a building, comprising:
 - a plurality of sensors configured for sensing and/or measuring a plurality of characteristics of the air in the at least one room;
 - a processor configured for collecting and processing the plurality of characteristics to generate air-related data; and
 - a transceiver configured for communicating the air-related data to a user device of a user and configured for communicating with a network of one or more devices that can modify the air in the at least one room.

Groth comment

Concept iii) does not involve all these elements. The control system iii) is thus considered to fall outside the provisional scope of position 18.



19) Family number: 70236598 (EP3339752 A1) © PatBase

Title: ROOM TEMPERATURE CONTROL SYSTEM

Priority: EP20160206125 20161222

Family:	Publication number	Publication date	Application number	Application date
	DE602016013139 D1	20190523	DE201660013139 T	20161222
	EP3339752 A1	20180627	EP20160206125	20161222
	EP3339752 B1	20190501	EP20160206125	20161222
	PL3339752 T3	20191129	PL20160206125T	20161222
	RU2671139 C1	20181029	RU20170143918	20171214

Probable Assignee: DANFOSS AS

Assignee(s):(std): DANFOSS AS

Inventor(s):(std): AMELINAS JUSTINAS ; HESSELD AHL SOREN ; NIELSEN PETER GAMMELJORD

Inventor(s): HESSELD AHL SOEREN

Agent(s): KNOBLAUCH ANDREAS; LYAPUNOV I PARTNER Y OOO

Designated states: AL AT BA BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR

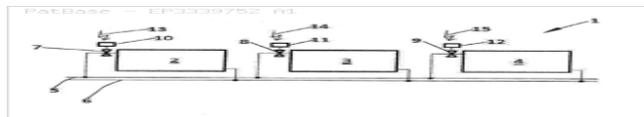
International class (IPC 8-9): [F24D19/10](#) [G05D23/19](#)

CPC: [F24D19/1018](#) [F24D2220/0257](#) [F24D2220/042](#) [G05D23/1931](#)

[Classification Explorer](#)

Abstract:

A room temperature control system (1) is shown having at least two radiators (2, 3, 4) located in the same room each radiator (2, 3, 4) being provided with a valve (7, 8, 9) for controlling a flow of heat carrying fluid through the respective radiator (2, 3, 4), each valve (7, 8, 9) being actuated by an electronic control unit (10, 11, 12) and the control system having at least one temperature sensor. Such a system should have a good comfort. To this end the control units (10, 11, 12) are part of a communication system (13, 14, 15) in which the control units (10, 11, 12) communicate with each other to share information and the control units (10, 11, 12) control the valves (7, 8, 9) according to the shared information.



Claim 1 of the EP patent regards

1. Room temperature control system (1) having at least two radiators (2, 3, 4) located in the same room, each radiator (2, 3, 4) being provided with a valve (7, 8, 9) for controlling a flow of a heat carrying fluid through the respective radiator (2, 3, 4), each valve (7, 8, 9) being actuated by an electronic control unit (10, 11, 12) and the control system having at least one temperature sensor, **characterized in that** the control system (1) comprises a communication system (13, 14, 15), wherein the electronic control units (10, 11, 12) are part of the communication system (13, 14, 15) in which the electronic control units (10, 11, 12) communicate with each other to share information and the electronic control units (10, 11, 12) control the valves (7, 8, 9) according to the shared information.

Groth comment

Concept iii) is not described to encompass e.g. valves (7,8,9) for controlling a flow of a heat carrying fluid through the respective radiators (2,3,4). Several of the further features of claim

1 are further not described in concept iii). Provided such features are not being used, concept iii) is not covered by the EP patent.

20) Family number: 75236398 (CN110056931 A) © PatBase

Title: INDOOR TEMPERATURE CONTROL METHOD OF WATER HEATING
 Priority: CN201910273513 20190405
 Family:

Publication number	Publication date	Application number	Application date
CN110056931 A	20190726	CN201910273513	20190405

Probable Assignee: HANGZHOU YUNGU ENERGY SAVING TECH CO LTD
 Assignee(s):(std): HANGZHOU YUNGU ENERGY SAVING TECH CO LTD
 Assignee(s): ENERGY SAVING VALLEY TECHNOLOGY CO LTD HANGZHOU CLOUD ; HANGZHOU YUNGU ENERGY SAVING TECHNOLOGY CO

Inventor(s):(std): CHEN LIJUN ; FU XIANRONG ; LI ZITING ; TANG XIAOJING

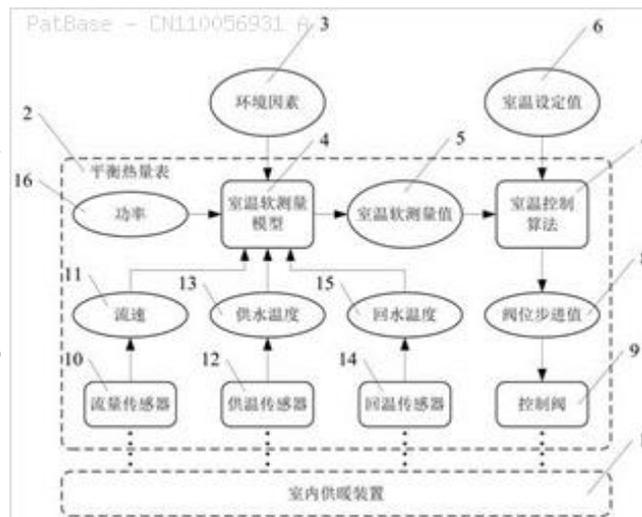
International class F24D19/10 F24D3/02 F24D3/10 F24F5/00
 (IPC 8-9):

CPC: F24D19/1015 F24D3/02 F24D3/1058 F24F5/0003

[Classification Explorer](#)

Abstract:

The invention discloses an indoor temperature control method of water heating. The indoor temperature control method comprises the steps of (1) obtaining process measurement values of an indoor heating device: supply water temperature, return water temperature, flow speed and power of the indoor heating device; (2) calculating a room-temperature soft measurement value according to the process measurement values and environmental factors so as to obtain a room temperature value; (3) calculating a control output value according to the room-temperature soft measurement value and a room-temperature set value; and (4) adjusting the power of the indoor heating device according to the control output value. The indoor temperature control method is a reliable method for realizing room temperature control of water heating without a room temperature sensor; the stability of room temperature measurement is improved, and the control effect is increased; the low-cost room temperature control of water heating is realized; and the integration of a measurement device and a room temperature control device can be realized, so that the reliability is increased.



Claim 1 of the still pending application reads

A water heating system of the indoor temperature control method, characterized in that: Step one, get the indoor heating apparatus of process measurements, including water temperature, return water temperature, flow rate, as well as indoor heating apparatus of power;

Step two, according to the process measurement value, combined with environmental factors to calculate room temperature soft measurement value, thereby to obtain room temperature value;



Step three, according to the room temperature and the room temperature set value Control Soft measurement calculation output value;

Step four, according to the control output value adjustment indoor heating device power.

Groth comment

It is not described in concept iii) whether e.g. a step including calculation of room temperature to obtain a room temperature value and in addition perform steps three and four including setting of a Control Soft value and adjust indoor heating device power. This position 20 is thus not considered to block concept iii).

21) Family number: 81012751 (EP3709122 A1) © PatBase

Title: APPARATUS FOR TEMPERATURE CONTROL OF ROOMS IN A BUILDING AND ASSOCIATED TEMPERATURE CONTROL METHOD

Priority: DE201910106091 20190311

Family:	Publication number	Publication date	Application number	Application date
	DE102019106091	20200917	DE201910106091	20190311
	A1			
	DE102019106091	20201224	DE201910106091	20190311
	B4			
	EP3709122 A1	20200916	EP20200161748	20200309

Probable Assignee: TTO THERMOTECHNIK D O O

Assignee(s):(std): TTO THERMOTECHNIK D O O

Inventor(s):(std): DRLJEVIC RADISAV

Agent(s): KLINGSEISEN RINGS AND PARTNER PATENTANWAELTE; RINGS ROLF

Designated states: AL AT BA BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR

International class [F24D19/10](#) [F24F11/00](#) [F24F11/62](#) [G05D23/19](#)
(IPC 8-9):

CPC: [F24F11/54](#) [F24F11/56](#) [F24F11/58](#) [F24F11/64](#) [F24F11/72](#) [F24F11/80](#)
[F24F11/84](#) [F24F2110/10](#) [F24F2110/20](#) [F24F2110/50](#) [G05D23/1931](#)
[G05D23/1934](#) [Y02B30/70](#)

Classification

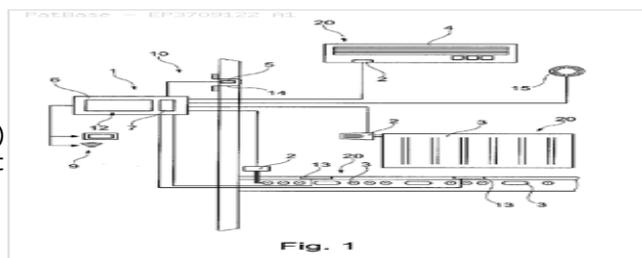
Explorer

Cited documents: US2015276238 AA, WO17062695 A1, WO15011446 A1, DE29709716 U, WO15014229 A1, DE29709716 U1,

Abstract:

Source: EP3709122 A1 [DE]

Temperaturregelungsvorrichtung (10) sowie Verfahren zur Temperaturregelung fuer eine Heiz- oder Kuehleinrichtung (20) von einzelnen Raeumen in Gebaeuden mit elektronisch ansteuerbaren Stellantrieben (2) von Heizeinrichtungen (3) oder Kuehleinrichtungen (4), welche ueber einen Raumtemperaturregler (1) geregelt sind, um eine voreingestellte oder einstellbare Soll-Temperatur des Raumes zu erhalten, wobei in dem Raumtemperaturregler (1) eine erfasste Ist-Temperatur des Raumes verarbeitet und mit der





jeweiligen Soll-Temperatur des Raumes verglichen wird und wobei die Stellantriebe (2) direkt oder indirekt mit dem Raumtemperaturregler (1) regelungstechnisch verbunden sind, wobei der Raumtemperaturregler (1) eine Kombination von mindestens einem Temperatursensor (5) in dem Raum und einem in einer davon separaten Steuereinheit (6) gespeicherten Regelungs-Programm ist, welches ausgebildet ist, um die Raumverhaeltnisse des Raumes, die Steilantriebe (2) und die Verbindungen zu den Stellantrieben (2) des jeweiligen Raumes abzubilden und bei der Temperaturregelung zusammen mit der durch den Temperatursensor (5) erfassten Temperatur zu beruecksichtigen.

Claim 1 reads

1. Temperature control device (10) for a heating or cooling device (20) of individual spaces in buildings with electronically controllable actuators (2) (3) of heaters or cooling devices (4), which is over a room temperature controller (1) to a preset or adjustable setpoint temperature of space, in the space of a sensed actual temperature of the room temperature controller (1) and processed with the respective desired temperature of the room, and wherein the actuators (2), directly or indirectly, to room temperature regulator (1) are connected in terms of control technology, **characterized in that** the room temperature controller (1) comprises a combination of at least one temperature sensor (5) in the space and a separate control unit (6) stored in a control program is adapted to the space ratios of the space, the actuators (2), and the connections to the actuators (2) the respective space and in temperature control by temperature sensor (5) together with the sensed temperature into account.

Groth comment

Concept iii) as described does not involve all the features of claim 1 and is thus not covered by the claim.

22) Family number: 82282397 (CN112032818 A)

© PatBase

Title: ROOM TEMPERATURE COOPERATIVE CONTROL METHOD FOR WATER SYSTEM HEATING

Priority: CN202010764309 20200802

Family:	Publication number	Publication date	Application number	Application date
	CN112032818 A	20201204	CN202010785909	20200807

Probable Assignee: HANGZHOU ENGRID TECH CO LTD

Assignee(s):(std): HANGZHOU ENGRID TECH CO LTD

Assignee(s): HANGZHOU ENGRID TECHNOLOGY CO ; VALLEY TECHNOLOGY CO LTD
HANGZHOU CLOUD

Inventor(s):(std): CHEN LIJUN ; DING YUN ; LI ZITING ; WANG JIAN ; WU WEIKANG

International class [F24D19/10](#)

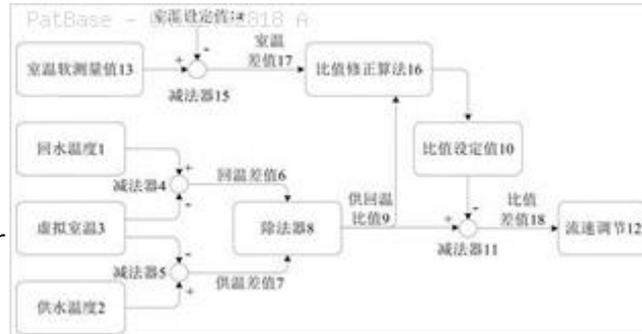
(IPC 8-9):

CPC: [F24D19/1009](#)

[Classification Explorer](#)

Abstract:

The invention discloses a room temperature cooperative control method for water system heating. The room temperature cooperative control method comprises the following steps: a return water temperature of a heating device is obtained, and a return temperature difference value between the return water temperature and a virtual room temperature is calculated; a water supply temperature of the heating device is obtained, and a supply temperature difference value of the water supply temperature and the virtual room temperature is calculated; a ratio of the return temperature difference value to the supply temperature difference value is calculated; and the ratio is compared with a set ratio, and the flow velocity of the heating device is adjusted according to a control algorithm. The virtual room temperature is an indoor temperature value or a temperature value close to the indoor temperature. The set ratio can be corrected according to the obtained indoor temperature value and a correction algorithm. The indoor temperature value is obtained by adopting a room temperature soft measurement technology. According to the room temperature cooperative control method, room temperature cooperative control of a heat supply area can be conveniently realized; a reliable method for controlling the heating room temperature of a water system can be realized without completely depending on an indoor temperature value; and the adjustment amplitude of control parameters can be reduced, and the service life of control equipment is prolonged.



Groth comment

Concept iii) does not involve all features of this position and thus not considered to be encompassed by it.

23) Family number: 59626595 (EP2889714 A1) © PatBase

Title: METHOD FOR CONTROLLING THE TEMPERATURE OF A ROOM AND UNIT FOR CONTROLLING THE ROOM TEMPERATURE

Priority: DE201310227178 20131227

Family:	Publication number	Publication date	Application number	Application date
	DE102013227178	20150702	DE201310227178	20131227
	A1			
	EP2889714 A1	20150701	EP20140195461	20141128

Probable Assignee: BOSCH GMBH ROBERT

Assignee(s):(std): BOSCH GMBH ROBERT

Assignee(s): ROBERT BOSCH GMBH

Inventor(s):(std): BOESVELD WILFRED ; BOESVELD WILLEM ; VERDAASDONK BART

Designated states: AL AT BA BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR

International class [F24D19/10](#) [G05D23/00](#) [G05D23/19](#)

(IPC 8-9):

CPC: [G05D23/1904](#)



Classification

Explorer

Cited documents: US2013099011 AA, DE4009774 A1, EP0444308 A2, US2008191045 AA, US6595430 BA,

Abstract:

Source: EP2889714 A1 [DE] Die Erfindung betrifft ein Verfahren zur Raumtemperaturregelung und eine Raumtemperaturregeleinheit mit einem Steuerungsmodul zur Regelung mindestens einer Raumtemperatur. Fuer eine selbststaendige Anpassung der Raumtemperatur erlernt das Steuerungsmodul einen zeitabhaengigen Verlauf der Raumsolltemperaturwerte anhand zugefuehrter Raumsolltemperaturwerte und legt diesen der weiteren Regelung zugrunde, wobei der Verlauf durch neu zugefuehrte Raumsolltemperaturwerte aktualisiert wird.

Groth comment

This position has been abandoned.

24) Family number: 10134497 (EP0631219 A1)

© PatBase

Title: METHOD FOR TEMPERATURE CONTROL AND REGULATION IN INDIVIDUAL LIVING OR WORK ROOMS.

Priority: AT19930001265 19930628

Family:	Publication number	Publication date	Application number	Application date
	EP0631219 A1	19941228	EP19940109633	19940622

Probable Assignee: BUDERUS HEIZTECHNIK GMBH

Assignee(s):(std): BUDERUS HEIZTECHNIK GMBH

Inventor(s):(std): FISCHER MICHAEL ; HEER MICHAEL ; HUTSTEINER FELIX DIPL ING ; MAYRHOFER HELMUT

Designated states: AT BE CH DE FR IT LI NL

International class F24D19/00 F24D19/10 F24F11/00 G05D23/19
(IPC 8-9):

International class F24F11/00 G05D23/19
(IPC 1-7):

CPC: F24D19/10 F24F11/00 F24F11/30 F24F11/64 F24F2110/10 F24F2120/10 G05D23/1902

Classification

Explorer

Cited documents: US5088645 A, JP5248680, JP5149598, JP2287038, GB2192080 A1, FR2549616 A1, EP0444308 A2, DE4009774 A1,

Forward Citations: EP2367087 B2, EP2367087 B1, CN103782109 B, US9282590 BB, CN103782109 A, WO12142477 A3, WO12142477 A2, FR2856166 A1, EP1489573 A1, EP0893748 A1, DE19600694 C2, DE19600694 A1, DE19738819 A1, DE19738819 C2, FR2957691 A1, EP2367087 A1, WO05024311 A1, WO9744720 A1, AU721496 B2, CH690875 A, US6263260 BA,

DE102008031099 A1

WO9901807 A1, EP1685351 B8, EP1770454 A1, EP0887722 A1, EP0900417 B1,

Abstract:

There are living rooms or work rooms which are only used from time to time but in which, in the course of time, a certain rhythm of use is set. Regulation in accordance with a rigid time plan would represent a waste of energy and, at certain times, would not correspond to the requirements arising. In contrast, the control, known per se, using presence detectors would not offer sufficient convenience, since no predictive intervention is possible. The spirit of the invention is to take into account constant habits of the occupants and, nevertheless, to achieve a maximum



in terms of energy-saving with optimum convenience. This is achieved in that a set time plan is adapted to the regularities of the use of the rooms which arise, using the presence times, recorded by means of presence detectors, on the following days, in accordance with a fuzzy algorithm.

Groth comment

This position is only included as an example of the state of the art (expired technology from 1994).

25) Family number: 46442184 (US2010252243 AA) © PatBase

Title: REFRIGERANT DISTRIBUTOR FOR HEAT EXCHANGER AND HEAT EXCHANGER

Priority: CN200910132009 20090403 EP20100003238 20100326

Family:	Publication number	Publication date	Application number	Application date
	CN101788243 A	20100728	CN200910132009	20090403
	CN101788243 B	20110928	CN200910132009	20090403
	DE602010025129 D1	20150723	DE201060025129T	20100326
	EP2241852 A2	20101020	EP20100003238	20100326
	EP2241852 A3	20140115	EP20100003238	20100326
	EP2241852 B1	20150610	EP20100003238	20100326
	US2010252243 AA	20101007	US20100751311	20100331
	US9423190 BB	20160823	US20100751311	20100331

Probable Assignee: DANFOSS SANHUA HANGZHOU MICRO CHANNEL HEAT EXCHANGER CO LTD

Assignee(s):(std): DANFOSS AS ; DANFOSS SANHUA HANGZHOU MICRO ; HUANG LIN JIE ; HUAZHAO LIU ; SANHUA HANGZHOU MICRO CHANNEL HEAT EXCHANGER CO ; SANHUA HANGZHOU MICRO CHANNEL HEAT EXCHANGER CO LTD ; SANHUA HOLDING GROUP CO LTD

Assignee(s): DANFOSS SANHUA (HANGZHOU) MICRO CHANNEL HEAT EXCHA ; DANFOSS SANHUA (HANGZHOU) MICRO CHANNEL HEAT EXCHANGER CO LTD ; DANFOSS SANHUA HANGZHOU MICRO CHANNEL HEAT EXCHANG ; DANFOSS SANHUA HANGZHOU MICRO CHANNEL HEAT EXCHANGER CO ; DANFOSS SANHUA HANGZHOU MICRO CHANNEL HEAT EXCHANGER CO LTD ; DANFOSS SANHUA MICRO CHANNEL HEAT EXCHANGER CO LTD ; SANHUA HANGZHOU MICRO CHANNEL HEAT EXCHANGER CO LTD HANGZHOU ; SANHUA HOLDING GROUP CO

Inventor(s):(std): HUANG LIN JIE ; HUAZHAO LIU ; NINGJIE HUANG

Inventor(s): HUANG LIN JIE EAST AMHERST ; HUANG NINGJIE ; LIU HUAZHAO

Agent(s): KNOBLAUCH ANDREAS; MCCORMICK PAULDING AND HUBER LLP; PATENTANWAELTE DR KNOBLAUCH PARTGMBB

Designated states: AL AT BA BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR

International class [F25B39/02](#) [F28D1/00](#) [F28F9/02](#) [F28F9/22](#)

(IPC 8-9):

CPC: [F25B39/028](#) [F28F9/0273](#)

US class: [1/1 165/174](#)

[Classification Explorer](#)

Cited documents: DE102006016839 A1

CA2289428 AA, US5806586 A, US3976128 A, US3232341 A, US3026092 A, US2942858 A, US1662236 A, US2002174978 AA, US7275394 BB, US6729386



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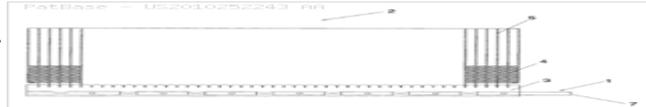
Established 1869

BA, US2008093051 AA, US7143605 BB, US7398819 BB, US1315853 A, US5743111 A, US2002088611 AA, US2006108099 AA, US2008013278 AA, US2009244895 AA, US2009272536 AA, US2252045 A, US3826304 A, US6363965 BA, JP2004278935 A2, EP1798507 A2, US6363965, JP2004278935, EP1798507,

Forward Citations: US2015168075 AA, US10982870 BB, US10082341 BB, US2015114590 AA, US2010242535 AA, FR3075348 A1, EP2650078 B1, CN109073343 B, CN109073343 A, CN107543336 A, CN107850396 A, US9885521 BB, CN103411463 A, CN101922882 A, WO12075766 A1,

Abstract:

A refrigerant distributor for a heat exchanger is disclosed. The refrigerant distributor comprises: a pipe for distributing a



refrigerant, the pipe having a channel therein in which the refrigerant flows. The channel has at least one portion having reduced cross-section area. With the above configuration, the distributor relieves the layering of refrigerant flowing in a distributing pipe and mixes the vapor-liquid refrigerant relatively uniformly.

Groth comment

Concept i) differs from position 25 at least in that it does not involve distances (d1, d2, d3) between the adjacent portions (6, 6', 6'') having reduced cross-section area of the plurality of portions having reduced cross-section area which gradually increase from the end to the other end of the pipe (9) as claimed in claim 1 thereof. Concept i) is thus not considered to fall within the scope of position 25.



Search strategy

ATAC=(distribut* and (decreas* or small* or taper*) w2 (area or cross* or volum*)) and APD=20010520:20210520 and SC=(F24D)

ATAC=(distribut* and (decreas* or small* or taper*) w2 (area or cross* or volum*)) and APD=20010520:20210522 and SC=(F28F)

F17C2227 and distribut* and header* and (decreas* or small* or taper*) w2 (area or cross* or volum*) APD=20010520:20210522

(header* or distibut*) and (floor* 2w heat*) and (dual or double or two or plural) F24D

AFT=((floor* 2w heat*) 2w (dual or double or plural)) and APD=20010520:20210522 and SC=(F24D)

ATAC=((header* or distibut*) and (floor* 2w heat*) and (dual or double or two or plural)) and APD=20010520:20210522 and SC=(F24D)

AFT=(distribut* and header* and (decreas* or reduc* or small* or taper*) w2 (area or cross* or volum*)) and APD=20010520:20210522 and SC=(F24D)

AFT=(distribut* and (decreas* or small* or taper*) w2 (area or cross* or volum*)) and APD=20010520:20210522 and SC=(F17C2227)

ATAC=(((const* or equilibr* or same or even*) w2 temperature*) and (room* pr zone* or space or building*)) and APD=20010520:20210522 and IC=(F17C2227 or F24D or F28F)

ATAC=(((const* or equilibr* or same or even*) w2 temperature*) 10w (room* or space or zone* or building*)) and APD=20010520:20210522 and SC=(F17C2227 or F24D or F28F)

ATAC=(dual* and (low* or sub* or accum* or buffer) w2 (circuit or layer or tub*)) and APD=20010520:20210522 and SC=(F17C2227 or F24D or F28F)

AFT=(dual* 2w layer* and floor* 2w heat*) and APD=20010520:20210522 and SC=(F17C2227 or F24D or F28F)

ATAC=(floor heat* 5w layers) and SC=(F17C2227 or F24D or F28F)

ATAC=((header* or distributor* and ((reduc* or decreas*)) 15w (cross-flow or cross flow or cross section)) and manifold*) and APD=20010520:20210522 and SC=(F17C2227 or F24D or F28F)

ATAC=((header* or distributor*) and (reduc* or decreas*) 3w volum* and (cross-flow or cross flow or cross section)) and APD=20010520:20210522 and SC=(F17C2227 or F24D or F28F)

AFT=((header* or distributor*) and (reduc* or decreas*) 3w flow direct* and pressure drop*) and APD=20010520:20210522 and SC=(F17C2227 or F24D or F28F)

ATAC=((header* or distributor*) and (reduc* or decreas*) 3w volum* and flow direct*) and APD=20010520:20210522 and SC=(F17C2227 or F24D or F28F)



Groth & Co

Established 1869

AFT=((header* or distributor*) and (reduc* or decreas*) 5w flow direct*) and
APD=20010520:20210522 and SC=(F17C2227 or F24D or F28F)

AFT=(temperature gradient and constant flow) and APD=20010520:20210522 and
SC=(F17C2227 or F24D or F28F)

ATAC=(temperature and (constant or continuous) 2w flow and floor*) and
APD=20010520:20210522 and SC=(F17C2227 or F24D or F28F)

ATAC=(AI and control*) and APD=20010520:20210522 and SC=(F17C2227 or F24D or
F28F)

AFT=(AI 10w room temperature) and APD=20010520:20210522 and SC=(F17C2227 or
F24D or F28F)

ATAC=((const* or equilibr* or same or even*) w2 room temperature*) and
APD=20010520:20210522 and SC=(F17C2227 or F24D or F28F)

ATAC=(control* and room temperat* and (algorithm* or iot)) and APD=20010520:20210526
and SC=(F17C2227 or F24D or F28F)

AFT=(control* 5w room temperat* 50w (algorithm* or iot or internet of things)) and
APD=20010520:20210526 and SC=(F17C2227 or F24D or F28F)

ATAC=(control* and temperat* 20w (algorithm* or iot or internet of things)) and
APD=20010520:20210526 and SC=(F17C2227 or F24D or F28F)