A REVIEW ON HEAT EXCHANGER HAVING DIFFERENT TYPES OF BAFFLES USED TO ENHANCE THE HEAT TRANSFER RATE

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***Abstract*: This paper is reviews about the enhancement of heat transfer through different heat transfer techniques. A Heat exchanger is equipment built for efficient heat transfer from one medium to another or from one body to other. The medium may be separated or in direct contact by a solid wall, so that it never mix or may be in direct contact. Different heat exchangers are widely used in petroleum refineries, natural gas processing, sewage treatment, space heating, refrigeration, air conditioning, power plants, chemical plants, petrochemical plants. The requirement of the current manufacturing and production industries directs the researchers in finding an alternative system which should be effective in the most efficient way. This paper revels the different methods and type of heat exchangers used to enhance the heat transfer. It also review different types of baffles used inside the heat exchanger to increase the heat transfer.**

***Keywords:* heat transfer enhancement, heat exchanger configurations, compact heat exchangers, Baffles type**

1. Introduction

Heat exchangers are devices that facilitate the exchange of heat between two fluids that are at different temperatures while keeping them from mixing with each other. In heat exchangers, there are usually no external heat and work interactions. Heat exchangers are commonly used in practice in a wide range of applications, from heating and air conditioning system in household, to chemical processing and power production in large plants. Heat exchangers differ from mixing chambers in that they do not allow the two fluids involved to mix. Heat transfer in a heat exchanger usually involves convection in each fluid and conduction through the wall separating the two fluids. In the Analysis of a heat exchanger, it is convenient to work with an overall Heat transfer co-efficient U, that accounts for the contribution of all these effects on heat transfer.

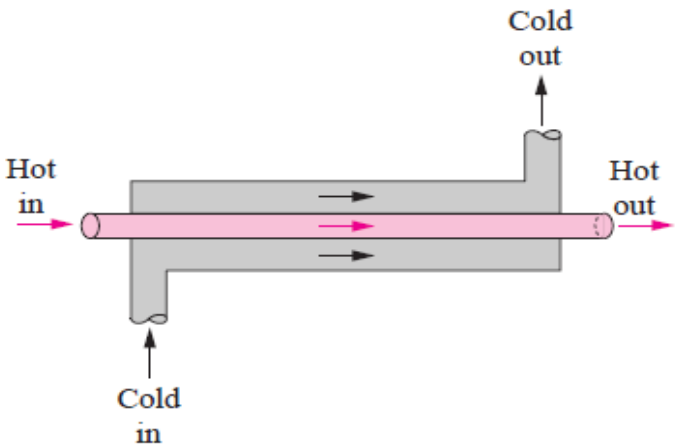

Fig.1 Schematic diagram of a double pipe parallel flow heat exchanger

2. Classification of heat exchangers

Heat exchangers may be classified as:-
a) Recuperators or Regenerators
b) Transfer process (direct or indirect contact)
c) Type of construction (tube, plate and extended surfaces)
d) Heat transfer mechanism (single phase and two phases)
e) Flow arrangement (parallel flow and counter flow or cross flow)

3. Existing Research work

To enhance the performance of heat exchanger many researchers have worked for optimizing the different parameters on which the performance of heat exchanger depends. Some of the research work related to the enhancement of heat transfer due to the use of different baffles inside the heat exchanger is mention in the below section.

1. Yan et.al (2018) it investigate, the start-up and the characteristics of heat transfer of a gravity-actuated separate heat pipe (GASHP) arrangement are practically investigated, including its evaporator section. Two aluminium micro-channel evaporators with different channel length were studied and the charging ratio involved in such area was mainly 60%. The outcomes indicated as the capacity of heat on evaporator, the air temperature and air velocity flowing over condenser had significant influences on the start-up characteristics, stability of operation and performance of heat transfer.

2. Singh et.al (2018) here in this work**,** energy is the primary input required to sustain the growth of any nation. As today, the world's environment is facing a serious threat of depleting fossil fuels, thus in order to sustain the economic growth new technologies are required to be developed that can efficiently utilize energy generated from earth's natural resources. Utilization of solar energy to convert it into thermal energy by solar air heater is one of them. But, the thermal efficiency of a solar air heater is found to be significantly low.

3. Patidar et.al (2018) in this work researchers found rate of heat transfer is being improved with the help of some active or inactive method of improvement of rate of heat in a heat exchanger as it provides an important role in a number of firms. The alterations which have been carried out by utilizing methods manipulate simple natural heat exchanger to augmented heat exchanger. As the heat exchanger shows an important role in our everyday life. It desires of being improved the heat transfer rate with few method. Twisted tape is utilized as the inactive methods to advance the efficiency of a heat exchanger and after this period there is a possibility of more in such area for the improvement of heat transfer and drop in pressure with different range of Nusselt number, Prandtl number with development on efficiency of heat transfer based on modified triangular baffled twist-straight turbulators.

4. Surywanshi et.al (2017) in this work, Heat exchanger application in industrial and its application in engineering is quite popular. The need is to improve rate of heat transfer, reduce drop in pressure with respect to long term routine aspect of equipment. The existing profile will be focused on transfer of heat improvement of heat exchanger by utilizing helical strip in circular pipe with working fluid as water. Circular pipe helical strip geometry is not reported yet into the exposed works. During the study of CFD analysis performed on helical strip in circular pipe heat exchanger geometry for numerous kink of ratios with keeping constant wall temperature it is concluded that as associated by means of simple pipe and twisted pipe, rate of heat transfer rises upto 50% to 70%.

5. Mathew et.al (2017) it investigate the conversion heat losses in the exhaust pipe into energy in an exhaust heat recovery system. Although the existing generation engines took up a smaller amount of fuel than they used to, the thermal efficiency of an internal combustion engine has not much improved since its formation. The foremost function of this work is to further advance the recovery of heat from the engine exhaust. By optimizing the design of the HEX fins, it is requisite to attain optimum transfer of heat with acceptable drop in pressure thats make back pressure in the exhaust. The heat exchanger used in such profile is a curved heat exchanger with finned tube which is supposed to deliver more transfer of heat than the heat exchangers of flat finned tube.

6. Li et.al (2017) it find out the effect of helical coils have gained ever more interest in the area of carbon dioxide of supercritical range with Rankine cycles through the past era due to the dense assembly and great rate of heat transfer. Previous analysis basically concentrated on influence of operational conditions and with the gravitational upthrust, and are not satisfactory to properly comprehend the behaviour of supercritical carbon dioxide gas heaters with helically coiled. Impact of few different main elements, such as the alignments of coil and roughness of inner wall, on full enactment that's been rarely stated and is still uncertain to date. In this work we filled such opening with a solid to fluid conjugate model of heat transfer where supercritical turbulence flow is explained by the Shear Stress Transport k-u functions.

7. Ali et.al (2017) This paper defines the thermal analysis of reclined parallel to surface of the ground and upright at right angle to surface of the ground, slinky horizontal ground heat exchangers with changed water rates of mass flow in the reheating manner of constant and discontinuous actions. A copper tube like an outer area secured with low density polyethylene has been designated as the tube material of the heat exchanger identified as ground. The practical thermal enactments of slinky horizontal ground heat exchangers standing and reclined orientation being taken into account in altered modes of heating.

8. Murthy et.al (2016) in this work, Improving surfaces of heat transfer are utilized in many engineering functions such as, air conditioning equipment, heat exchangers and many more areas. Both active and inactive methods that is being examined on improvement of heat transfer. Passive heat transfer method is one of the utmost important methods that are utilized. In the zone of heat transfer, studies have been made out over numerous of years for the growth of convective heat transfer improvement methods. The additives used in the base fluid as water or ethylene glycol is one of the methods functioned to expand the heat transfer.

9. Pawar et.al (2016) In past few years many of the mechanical, practical and mathematical models are being existed on shell with tube in combination tube heat exchanger by several scholars. In the firms where shell and tube heat exchangers are utilized for various applications example for heat recovery waste, oil refineries and so on. This analysis concentrated on the practical research of shell and tube heat exchanger with distinguished type of baffles. The shell and tube heat exchanger with segmental baffles and flower baffles are calculated, made-up and verified.

10. Bandos et.al (2016) in this work, method to get the key to the determinate source as cylinder model for the heat exchangers with ground at a distinct concealed depths that are taking into account the capacity of heat inside them and permits random rate of heat changes are obtained. Logical evaluations for the temperature of the ground taking average are justified by integrating the particular results over the cylinder source as depth for vertical and time dependent modifications of the heat rate. Fresh results for mean temperature replies from ground heat exchanger modelled as finite cylinder source of uniform heat flow implanted into the semi-infinite zone on a distance D from its surface being existed in a solo integral pattern.

11. Sheikholeslami et.al (2016) it calculate the turbulent hydrothermal study of forced convection in a heat exchanger of double pipe is existed practically. Now perforated turbulators are used in annulus area. Hot water generates the cold air in the outer tube warmer. Different quantities of ratio of pitch, ratio of open area and Reynolds number are deliberated. Relationships for Nusselt number, performance of thermal and Darcy factor of friction are tested. Impacts of perforated circular ring on stream type and thermal treatment in a heat exchanger of water to air are observed. The effect of PR; k and Rea on hydrothermal activity are calculated. Relationships of Nu, f and g have been provided.

12. Sheikholeslami et.al (2016) In this particular analysis, transfer of heat as well as loss in pressure in an air with water double pipe heat exchanger are practically examined. Typical circular ring and perforated circular ring turbulators are positioned in circular pipe. The occupied gases like air, flowing in the circular pipe, and water in the inner circular pipe. The tests are led for distinct leading constraints viz.; air flow of Reynolds number, pitch ratio and number of perforated hole are estimated. Relationships among friction factor, Nusselt number and thermal performance are obtainable according to practical documents.

13. Sheikholeslami et.al (2016) it investigate the, **i**mpact of distinctive and perforated uneven helical tarbulators on flow and in transfer of heat in an air to water double pipe heat exchanger are practically analysed. According to the practical facts, relationships among Nusselt number, friction factor and performance of thermal parameter are accessed as functions of distinct constraints. Non-dominated Sorting Genetic Algorithm II is in action to get the maximum high efficiency of designed heat exchanger. Practical steps are being showed to examine flow to be turbulent and transfer of heat in an air to water heat exchanger prepared with usual and perforated intermittent helical turbulators.

14. Sheikholeslami et.al (2016) Effect of perforated and distinctive helical fin on hydrothermal action in water to air heat exchanger is obtained. Water as well as air moving over inner and outer pipes, correspondingly. Influence of ratio of pitch, Reynolds number and ratio of open area are studied. Empirical formulations for performance of thermal parameter, Darcy factor and Nusselt number are achieved. Impacts of perforated fins with helical coil on current type as well as thermally treated water to air heat exchanger are scrutinized. The impacts of PR and Rea on hydrothermal behaviour are analysed.

15. Serageldin et.al (2016) In the this paper we analyses the thermal behaviour of an Earth-Air Heat Exchanger utilized for heating as well as cooling purposes and is explored under Egyptian weather situations. The soil temperature contour as well as the temperature variation of moving air through horizontal Earth-Air Heat Exchanger is practically examined. Also, a calculated model based on non-uniform, one-dimensional and quasi-state is established for conservation of energy equation while, the standard model is useful to find the turbulence kinetic energy of the moving fluid. The statistically advanced model and computational fluid dynamics calculation conclude the validation against investigational outcomes.

4. Conclusion

The performance of the heat exchanger will be improved by mounting Protrusion on the surface. The surface geometries, which are popular in different industrial applications, are wavy fins, off strip fins, perforated fins and louvered fins. With the use of Discontinuous helical baffles heat transfer rate get enhanced much higher as compared to the other types of baffles used.

References

[1] Qiao Yan, Li Jia, Experimental investigation on start-up and heat transfer performance of gravity-actuated separate heat pipe, Joint 19th IHPC and 13th IHPS, Pisa, Italy, June 10-14, 2018.

[2] Sahil Singh, Sahil Thappa, Harsimran Singh, Tejbinder Singh, Various Roughness Geometries used in Solar Air Heater – A Review, International Journal of Scientific and Technical Advancements, Volume 4, Issue 1, pp. 151-156, 2018.

[3] Virendra Patidar, Nishant Vibhav Saxena, ENHANCEMENT OF HEAT TRANSFER THROUGH PIPE WITH THE HELP OF VARIOUS TYPES OF TURBULATORS – A REVIEW, International Research Journal of Engineering and Technology (IRJET) Volume: 05 Issue: 01 Jan-2018, e-ISSN: 2395-0056.

[4] Sachin S. Surywanshi, Sanjay V. Kadam, Suhas S. Mohite, Numerical Heat Transfer Analysis of Flowing Fluid through a Circular Tube with Helical Twisted Strip Inserts, Journal of Advances in Science and Technology Vol. 13, Issue No. 1, (Special Issue) March-2017, ISSN 2230-9659.

[5] Prof. Reji Mathew, Alan S Chackalayil, Feizal Fidus, Optimization of Curved Finned-Tube Heat Exchangers for Diesel Exhaust Waste Heat Recovery using CFD, GRD Journals- Global Research and Development Journal for Engineering | Volume 2 | Issue 6 | May 2017.

[6] Zhouhang Li, Yuling Zhai a, Dapeng Bi c, Kongzhai Li a, *, Hua Wang a, Junfu Lu, Orientation effect in helical coils with smooth and rib-roughened wall: Toward improved gas heaters for supercritical carbon dioxide Rankine cycles, Energy 140 (2017) 530e545.

[7] Zhe Wang, Yanzhong Li, A combined method for surface selection and layer pattern optimization of a multistream plate-fin heat exchanger, Applied Energy 165 (2016) 815–827

[8] Md. Hasan Ali, Keishi Kariya, Akio Miyara, Performance Analysis of Slinky Horizontal Ground Heat Exchangers for a Ground Source Heat Pump System, www.mdpi.com/journal/resources 2017, 6, 56; doi:10.3390/resources6040056.

[9] Shankara Murthy.H.M, Dr. Ramakrishna.N.Hegde, A critical review of combined augmentation techniques used for heat transfer enhancement in heat exchangers, National Conference on Advances in Mechanical Engineering Science (NCAMES-2016).

[10] Pooja J. Pawar, Rupesh J. Yadav, Experimental investigation of shell-and-tube heat exchanger with different type of baffles, Accepted 15 June 2016, Available online 20 June 2016, Special Issue-5 (June 2016).

[11] Tatyana V. Bandos, Alvaro Campos-Celador, Luis M. Lopez-Gonzalez,Jose M. Sala-Lizarraga, Finite cylinder-source model for energy pile heat exchangers: Effect of buried depth and heat load cyclic variations, Applied Thermal Engineering 96 (2016) 130–136.

[12] M. Sheikholeslami, M. Gorji-Bandpy, D.D. Ganji, Experimental study on turbulent flow and heat transfer in an air to water heat exchanger using perforated circular-ring, Experimental Thermal and Fluid Science 70 (2016) 185–195.
[13] M. Sheikholeslami, M. Gorji-Bandpy, D.D. Ganji, Effect of discontinuous helical turbulators on heat transfer characteristics of double pipe water to air heat exchanger, Energy Conversion and Management 118 (2016) 75–87.
[14] M. Sheikholeslami, D.D. Ganji, Heat transfer enhancement in an air to water heat exchanger with discontinuous helical turbulators; experimental and numerical studies, Energy 116 (2016) 341e352.
[15] M. Sheikholeslami, D.D. Ganji, Heat transfer improvement in a double pipe heat exchanger by means of perforated turbulators Energy Conversion and Management 127 (2016) 112–123.