The International Journal Of Engineering And Science (IJES)
|| Volume || 3 || Issue || 9 || Pages || 51-53 || 2014 ||
ISSN (e): 2319 – 1813 ISSN (p): 2319 – 1805

Thermostatic Valve In Geyser System

Sudhanshu Pandey

Department Of Mechanical Engineering, SRM University, Kattankulathur Campus

----------ABSTRACT----------

A Thermostatic Valve Is An Advanced Valve That Can Be Implemented In The Geyser System For Obtaining Continuous Supply Of Hot Water From Geyser In Places Where The Consumption Rate Is High. A Thermostatic Valve Is A Closed Valve Containing A Piston Inside It. The Upper And Lower Parts Of The Piston In The Valve Is Filled With Gas. One Side Of This Valve Is Made Up Of Thermal Conducting Material, While Others Sides Are Adiabatic. The Conduction Of Heat Takes Place From The Hot Water In The Geyser Tank To The Gas Inside The Thermostatic Valve. This Heat Causes The Gas Inside The Valve To Expand. This Expansion Leads To The Movement Of The Rod Attached To The Piston To Move Downwards. This Piston Contains A Hole Which Controls The Amount Of Normal Water Discharged At Outlet. A Separate Pipe Is Used To Discharge Hot Water At Outlet Directly From The Geyser Tank. Thus ,The Net Water At Outlet Contains A Mixture Of Hot And Cold Water And The Amount Of Cold Water Discharged Is Dependent On The Temperature Of Hot Water. This Helps To Avoid The Wastage Of Overheated Outlet Water, When Water Is Directly Taken From The Geyser Tank . This Valve Also Enables Us To Get A Continuous Supply Of Hot Water In Places Where The Consumption Rate Is High Because We Are Not Using The Hot Water Directly, But A Mixture Of Hot And Normal Water. So The Hot Water In The Geyser Tank Can Be Utilised For A Longer Time.

KEYWORDS: *Consumption, Conduction, Expansion, Geyser, Thermostatic, Valve.*

Date of Submission: 16 September 2014 Date of Publication: 25 September 2014

I. INTRODUCTION

An Electric Geyser Has Some Coils Dispersed In The Heating Container. When Electric Current Is Passed Through These Coils, Due To The High Resistive Effect Of The Coils, The Coil Gets Heated Up When Current Is Passed Through Them. This Heat Is Transferred To The Water Through Convection, Which Ultimately Heats Up The Water. A Thermostat Is Also Attached To The Geyser System. Thermostat Cuts Off The Current Supply When The Maximum Temperature Limit Of Hot Water Is Reached But Such A Geyser System Can't Be Helpful For Providing Continuous Supply Of Hot Water For High Consumption Applications Because At Times, Complete Hot Water Is Taken Out From The Geyser Tank .In Such Cases, Time Is Lost In Reheating The Water When The Consumption Is Continuous.

II. WORKING PRINCIPLE

The Outlook Of The Thermostatic Valve Is Shown Below In Figure 1.This Valve Contains A Piston With A Rod Attached To It As Shown Below In Figure 2.This Piston Has A Curved Upper Portion And Flat Lower Portion. A Gas Is Filled On Either Side Of The Faces Of The Piston In An Air Tight Arrangement Inside The Valve. The Top Portion Of The Thermostatic Valve Is Made In Contact With The Hot Water Of The Geyser Tank ,Separated By A Thermal Conducting Layer. Due To Heat Conduction From The Geyser Water To The Air Inside The Thermostatic Valve, The Air Expands. This Expansion Of Air Causes The Piston To Move Down. This Expansion Is Dependent Upon The Temperature Of The Of The Geyser Water. As The Piston Moves Down, The Rod Attached To The Piston Moves Down. This Rod Contains A Hole Of Diameter Same As The Diameter Of Normal Water Tank Pipe. Thus Depending Upon The Temperature Of The Hot Water In The Geyser Tank, There Is A Corresponding Displacement Of The Hole Attached To The Piston Rod. This Hole Acts As A Connector Between The Two Parts Of The Cold Water Pipe As Shown In

Figure 3. The Thermostatic Valve Is Designed In Such A Way That When The Maximum Temperature Limit Of Geyser Water Is Reached, The Hole Completely Fits The Cold Water, Thus Enabling The Maximum Discharge Of Cold Water At The Outlet.

Figure 1 Catia model of thermostatic valve

Figure 2 Catia model of piston inside the thermostatic valve

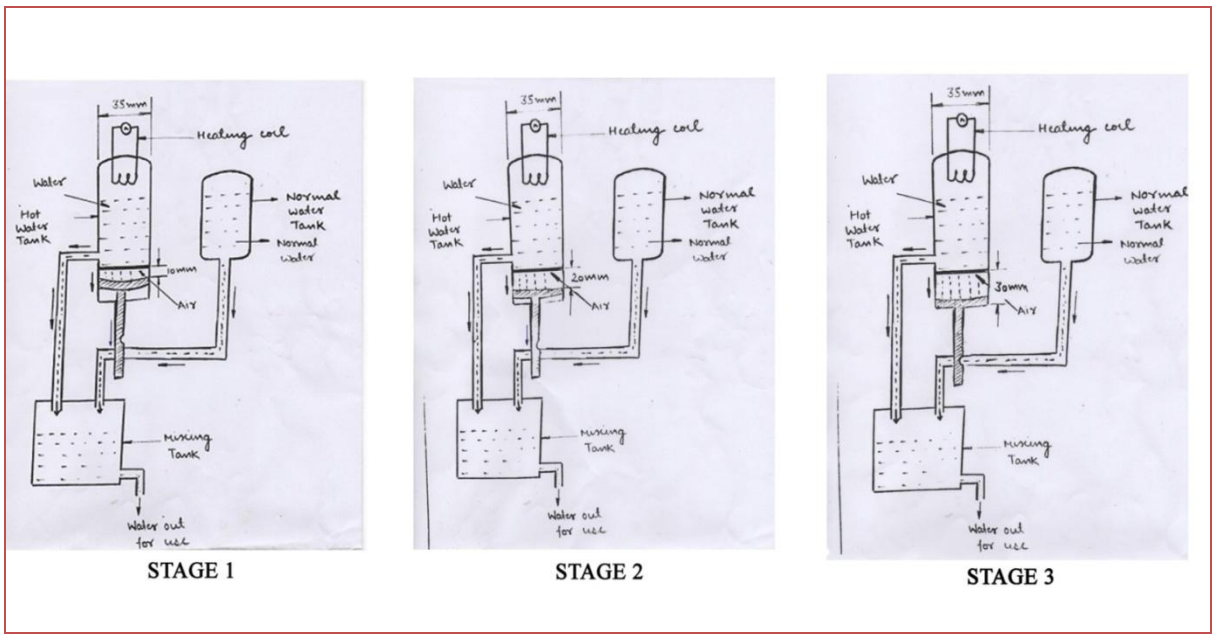
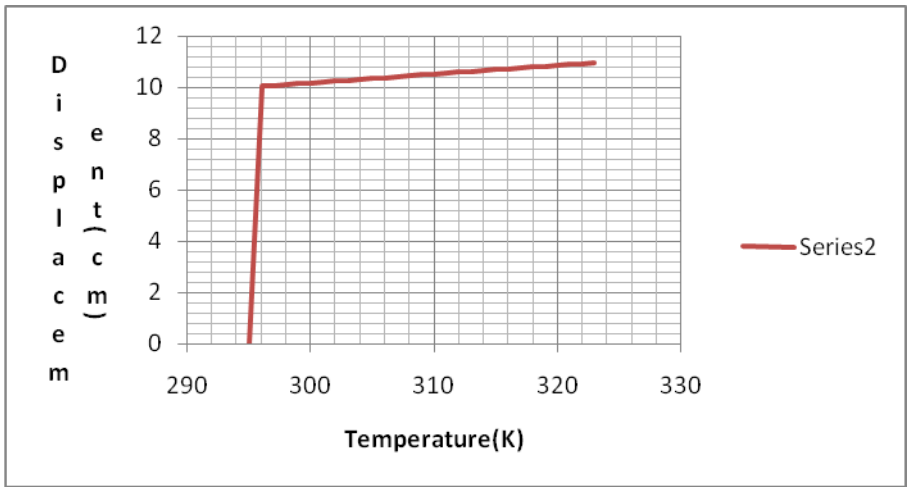


Figure 3: representation of complete mechanism in progressive stages

Taking air as an ideal gas inside the thermostatic valve and considering the expansion process to be quassi static constant pressure heat addition process,the displacement of piston for varying tempearture of the hot water is shown below :

temperature	T2/T1	volume(cm3)	displacement(cm)
295		9621.127	0
296	1.00338	9653.741	10.03
297	1.00337	9686.274	10.064038
298	1.00336	9718.819	10.09785294
299	1.00335	9751.378	10.13168174
300	1.00334	9783.948	10.16552156
301	1.00333	9816.528	10.19937259
302	1.00332	9849.119	10.23323464
303	1.00331	9881.72	10.26710666
304	1.0033	9914.329	10.30098814
305	1.00328	9946.848	10.33477507
306	1.00327	9979.375	10.36857011
307	1.00326	10011.91	10.40237158
308	1.00325	10044.44	10.43617316
309	1.00324	10076.99	10.46999251
310	1.00323	10109.54	10.50381066
311	1.00322	10142.09	10.53763293
312	1.00321	10174.65	10.57145823
313	1.0032	10207.21	10.60528703
314	1.00319	10239.77	10.63911827
315	1.00318	10272.33	10.67295066
316	1.00317	10304.89	10.70678392
317	1.00316	10337.46	10.74061736
318	1.00315	10370.02	10.77445026
319	1.00314	10402.58	10.80828207
320	1.00313	10435.14	10.842112
321	1.00312	10467.7	10.8759403
322	1.00311	10500.25	10.9097
323	1.0031	10532.8	10.943583



III. CONCLUSION

From above we can conclude that for every 3Kelvin rise in temperature of the water in the geyser tank, the displacement of the piston is approximately 1 mm. Initially for the first 1 kelvin rise, the displacement obtained is 10.03 cm. Till this distance the piston comes on the verge of opening the inlet of normal water , which is mixed with hot water. Thereafter, for every 1 kelvin rise we get a displacement of 1mm, thus enabling the passage of cold water through that 1mm opening that gets mixed with the hot water. For each 28 kelvin rise in temperature, the displacement becomes around 10mm (taking inside diameter of geyser tank =35cm, initial thickness of air chamber = 10 cm). The displacement rate decreases after first 1 kelvin rise because as the piston moves down, the air below the flat face of the piston gets compressed ,thus providing opposing force to the piston movement. So, for varying temperature ranges the displacement rate can be controlled by changing the gases of different compressibility in the thermostatic valve.

REFERENCES

[1] Er. R.K. Rajput, Thermal Engineering (Lakshmi publication)

[2] P K NAG, Engineering Thermodynamics (Mc Graw-Hill Education)