EXPERIMENTAL INVESTIGATION OF EFFECTIVENESS OF HEAT WHEEL AS A ROTORY HEAT EXCHANGER

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Abstract

General

Today's condition is continuous deduction of usable energy potential. Everything, everyone requires energy to survive, it may be living or may be non-living like machine, engines etc. Conventional sources of energy are degradable, thus research is going on to use non-conventional sources of energy, but it can't possible that all conventional sources replaced by non-conventional sources in day to day life till today and long years later on. So while using conventional sources, recovery of waste heat is only the solution to increase the life span of conventional sources. Our main intention should be to save as maximum energy as possible in any application. There are some applications related sources where the energy goes waste in the form of heat.

Our project is experimental test rig of Heat Wheel. The basic function of Heat wheel is recovery of waste heat in vapour stream. By this project we have to prove that heat wheel is more effective for recovery of latent as well as sensible heat. Generally heat recovered is transferred to air and then it is supplied for space heating, combustion etc. in various industries.

In this case steam is one fluid and air is another fluid. The steam is considered to be vapour stream which would be wasted just like vapour stream in industries. By measuring steam temperature and air inlet-outlet temperature, it is possible to determine effectiveness of heat wheel. Also we can find efficiency of wheel to condensed steam. Thus experimental test rig have to make to demonstrate effectiveness of heat wheel as Rotary Heat Exchanger. Heat wheel also comes in the category of rotary matrix type heat exchanger.

The Heat Wheel is a device which can transfer latent heat of moisture by condensing it. The heat is transfer through medium of porous conductive and absorptive material of wheel. It is cleared that heat wheel can transfer heat from air to air for small temperature difference also.

Literature Review

The concept of Heat Wheel generally comes from Waste heat recovery. Many scientist and engineers have been worked over waste heat recovery. In 1979 the scientist D.A. Reay and F.N. Span from London worked for adapting various devices of Recovery of waste heat in industries. They introduced the Devices like Recuperator, Air preheater, Thermo compressor etc.

Heat Wheel was firstly invented in order to recover waste heat of exhaust air in air conditioning system. In the mid 1970s, two Enthalpy Wheel products were introduced to industries. One was the oxidized Aluminium Wheel made up of corrugated Aluminium foil and second used silica gel as desiccant.

Dr. Thiensville and Konstantins Dravnieks in 1981 published a paper Heat Transfer Medium for Rotary Heat Transferrers and Heat Wheel Construction for US Patent. It gives constructional details, materials of medium of porous wheel. Jhon C.Fischer and Jr. Marietta published paper High Efficiency Sensible And Latent Heat Exchange Media With Selected Transfer For Total Energy Recovery Wheel in 1988 for US Patent. It gives concept of Sensible and Latent heat.

In 1995 S.A. klein and J.W. Mitchell published a paper as Performance of Rotary Heat and mass Exchanger. Also in 1999 R.W. Besant published a paper as Energy Wheel Effectiveness. Both worked for humidification control in outdoor air system by using enthalpy wheel also called as Heat Wheel. ASHRAE have been given very much contribution in research of Heat wheels. All these researches are limited for application of air conditioning with air to air heat transfer.

The enterprise Innergy Tech inc made ARI certified Energy recovery wheel. The standard Dimensional data is available in its booklet. It has given the information about general specifications, product specification, purge and casing assembly, Rotor seals, Rotor frame system, Drive system and Performance Specifications.

Our intention of the project is beyond the application of air conditioning. Heat wheel is rotary heat exchanger, it can transfer heat from one fluid to another like vapour, air etc. Thus Heat wheel can be used for waste recovery just like conventional heat exchanger.

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1. WASTE HEAT RECOVERY

Waste heat is the heat, which is generated in a process by way of fuel combustion or chemical reaction, and then "dumped" into the environment even though it could still be reused for some useful and economic purpose. The essential quality of heat is not the amount but rather its "value". The strategy of how to recover this heat depends in part on the temperature of the waste heat gases, and the economics involved. Large quantity of hot flue gases is generated from Boilers, Kilns, Ovens and Furnaces. If some of this waste heat could be recovered, a considerable amount of primary fuel could be saved. The energy lost in waste gases cannot be fully recovered. However, much of the heat could be recovered and loss minimized.

In considering the potential for heat recovery, it is useful to note all the possibilities, and grade the waste heat in terms of potential value as shown in the Table 3.1.

In this table, it has been mentioned that vapour stream is also the source of waste heat. Vapour is gaseous state of any liquid. When liquids convert to vapour state they continuously absorb the latent heat which is non-sensible. Waste vapour produces due evaporation of water, industrial processes like heating, chemical reaction etc. Latent heat can be recovered by condensing such a type of vapour. We would like to introduce another type of vapour stream as low pressure steam in power plants, sugar factories, process industries etc.

2. DEVICES OF WASTE HEAT RECOVERY

2.1 Recuperators

In a recuperator, heat exchange takes place between the flue gases and the air through metallic or ceramic walls. Duct or tubes carry the air for combustion to be pre-heated; the other side contains the waste heat stream. A recuperator for recovering waste heat from flue gases is shown in figure 3.1.

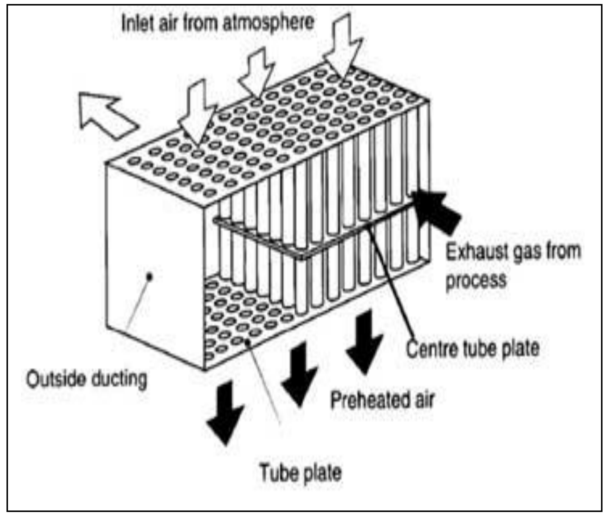


Fig. 2.1 Waste Heat Recovery using Recuperator

2. Thermo-compressor

In many cases, very low pressure steam is reused as water after condensation for lack of any better option of reuse. In many cases it becomes feasible to compress this low pressure steam by very high pressure steam and reuse it as a medium pressure steam. The major energy in steam is in its latent heat value and thus thermo-compressing would give a large improvement in waste heat recovery. The thermo-compressor is simple equipment with a nozzle where HP steam is accelerated into a high velocity fluid. This entrains the LP steam by momentum transfer and then recompresses in a divergent venturi. A figure of thermo-compressor is shown in Figure 3.2. It is typically used in evaporators where the boiling steam is recompressed and used as heating steam.

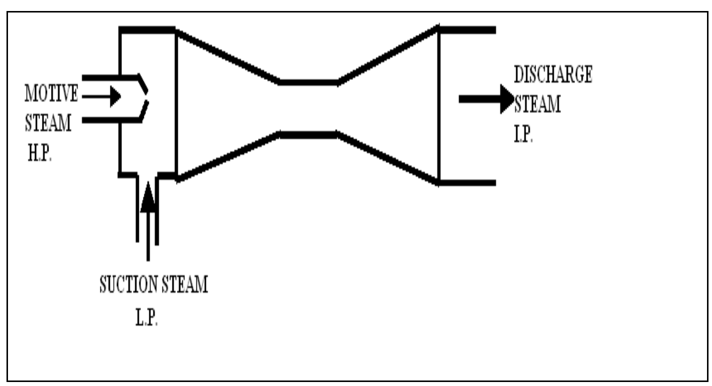


Fig. 3.2 Thermo-compressor

3. Heat Wheels

A heat wheel is finding increasing applications in low to medium temperature waste heat recovery systems. Figure 3.3 is a sketch illustrating the application of a heat wheel. It is a sizable porous disk, fabricated with material having a fairly high heat capacity, which rotates between two side-by-side ducts: one a cold gas duct, the other a hot gas duct. The axis of the disk is located parallel to, and on the partition between, the two ducts. As the disk slowly rotates, sensible heat (moisture that contains latent heat) is transferred to the disk by the hot air and, as the disk rotates, from the disk to the cold air.

The overall efficiency of sensible heat transfer for this kind of regenerator can be as high as 85 percent. Heat wheels have been built as large as 21 meters in diameter with air capacities up to 1130 m3 / min. A variation of the Heat Wheel is the rotary regenerator where the matrix is in a cylinder rotating across the waste gas and air streams. The heat or energy recovery wheel is a rotary gas heat regenerator, which can transfer heat from exhaust to incoming gases. Its main area of application is where heat exchange between large masses of air having small temperature differences is required. Heating and ventilation systems and recovery of heat from dryer exhaust air are typical applications. The heat wheel rotates between 2-20 RPM.

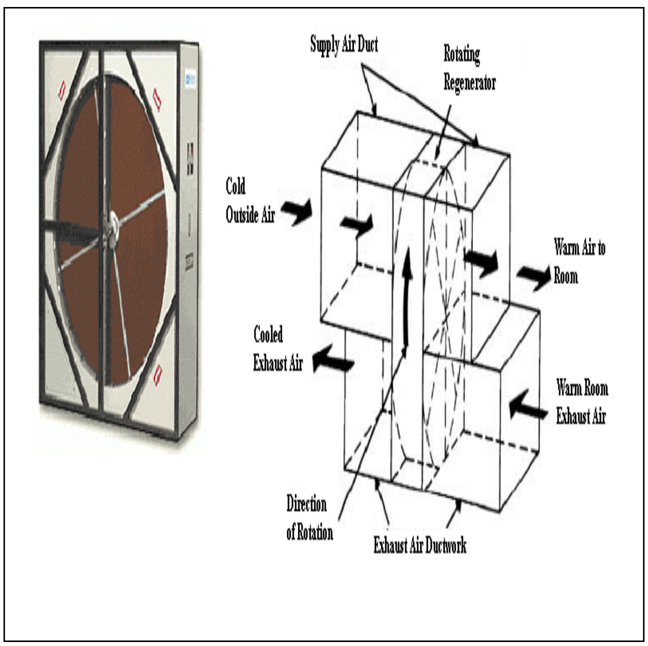


Fig. 3.3 Heat Wheel

3. EXPERIMENTAL SETUP

Aim: To find effectiveness of the heat wheel and to compare, it with ordinary/conventional plate type heat exchanger.

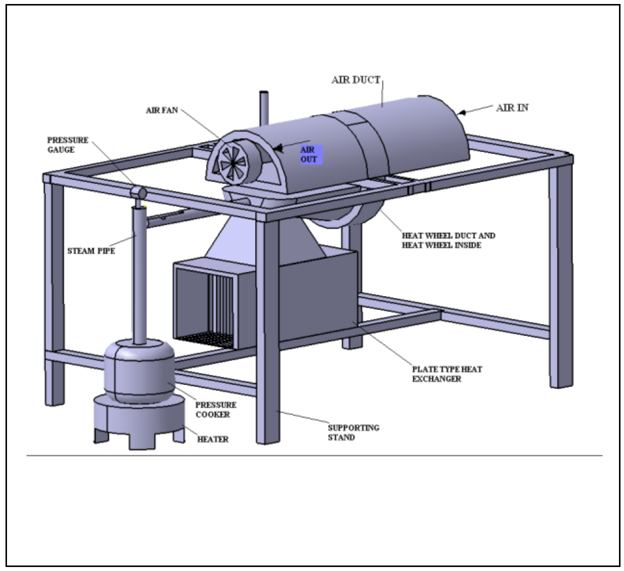


Fig. 3.1 3D view (outline) of Setup

Details of Setup

The setup of heat wheel consists of different parts like pressure cooker, heating-coil, inlet duct for air as well as outlet duct for outlet air in the half cylindrical form.

Different parts are mounted on the frame as shown in figure 4.1 and figure 4.2, which is made up of angle and square bar. The steam is generated inside the pressure cooker which acts as a baby boiler. The heating coil which is connected with ac power supply having a capacity of 2000 watt. The heat is carried away by water inside the cooker and steam is generated. This steam is then given to the inlet duct as shown in figure 4.1 and figure 4.2.

Two partitions are created in the form of two different ducts. These ducts are separated by the sealing to achieve leak-proof joint. The rotation is given to the heat wheel with the help of electric motor. As the wheel is continuously rotated the Aluminium tubes becomes cold when it comes in contact with cold air supplied from another duct. This duct is having forced and induced fans which supply the cold air to wheel. As the cold air come in contact with tubes it carries away heat from the Aluminium tubes. Hot air is then flow through the outlet duct provided opposite to that of duct for cold air. When the steam comes in contact with the cold wheel in another partition it gets condensed by transferring latent and sensible heat to wheel material.

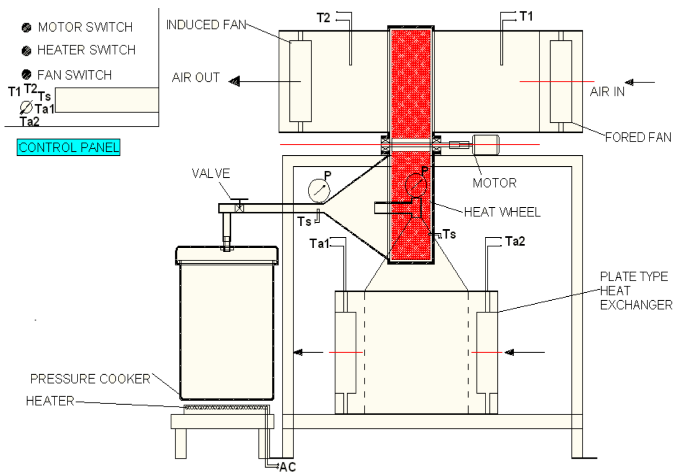


Fig. 3.2 Layout of Test Rig/ Setup

Specifications of Standard Parts

Sr. No.	**Particular**	**Description**	**Value**
1	Shaft	Diameter Material	12mm Hardened steel
2	Bearing	Bearing no.	6201
3	Motor	Power and speed Geared DC	6 watt, 3.5 rpm.
4	Fan	Current and Voltage RPM 2 in no	220/240 ac, 0.14A 2700
5	Temperature sensors	Thermocouple probe Indicator 7 segment digital display Power supply	0-400^{0}C 220/240V ac
6	Pressure cooker	Capacity Pressure	9 lit 1-1.5bar(absolute)
7	Electric Heater	Power	2KW, 220/240V ac
8	Pressure gauge	Bourdon Pressure gauge Range Dial size	0-2.1bar $1^1/_2$inch
9	Flexible PVC pipe	For half inch	-
10	Piping	Half inch G.I pipe	-
11	Steel sheet	CRC Thickness	0.5mm
12	Alluminium Sheet	Thickness	0.32mm
13	Adhesive	Araldite	-
14	Nuts and Bolts	M.S., M5(1 inch 10nos)	-
15	Valve	Lever operated gate valve.	-

4. DESIGN OF VARIOUS PARTS

4.1 General

Design part consist Design of Heat Wheel, Design of Ordinary/conventional plate type Heat Exchanger. Before going to design we must have to determine maximum flow rate of steam for which heat wheel is to be design. It can be determine by considering standard part specifications and charts available.

4.1.1 Design Data

Pressure of steam in pressure cooker= 1 bar to 1.5 bar.

Assume pressure of steam to be atmospheric.

P=1.01325bar.

At this pressure hf= 419.7kj/kg
hg= 2676kj/kg
vg=1.651m3/kg from steam tables

Heater capacity= 2KW.

The spacing between heating coil and cooker bottom is 1cm.

Heating coil radius= 100mm

From chart of shape factor between two circular surfaces is given by, F1-2=0.9 (appr.) ….from Heat Transfer book of D.S. Pawaskar.

Rate of heat given to cooker= F1-2 × 2KW
= 0.9 × 2000
= 1800W

4.1.2 Calculation to determine maximum steam flow rate

This heat is used to convert water into steam.
∴ 1800 = ms × hg

assuming steam to be dried and saturated
∴ 1800 = ms× 2676 ×103

∴ ms = 6.726 × 10-4 kg/sec.

Volume flow rate = ms × vg ….. (4.2)
= 6.725 × 10-4 × 1.651
= 1.11 × 10-3 m3/sec.
Q = 1.11 lit/sec.

This is the maximum flow rate of steam for which we have to design the heat wheel setup.

4.2 Design of Heat Wheel

Design of heat wheel includes three parameters Diameter D1 and D2, Width W, Porous diameter (d) as shown in figure 4.1.

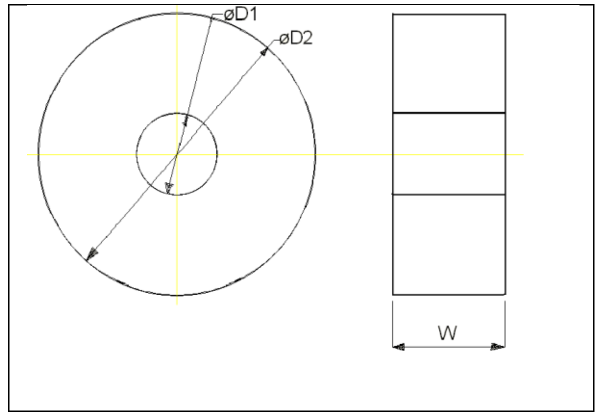
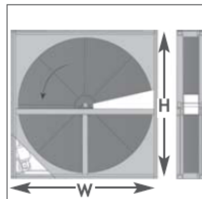


Fig. 4.1 Design parameters of heat wheel

Diameter D_1, D_2
Here, D1=60mm for constraint of bearing and pedestal.

The standard dimensional data of heat wheel which is ARI 1060 certified for Innergy tech inc. is given in table.4.1

Table 4.1 Dimensional Data of Heat Wheel



Diameter in/mm	Width (W) in/mm	Height (H) in/mm	Depth(D) in/mm	Weight lb/kg
48/1219	58/1473	58/1473	15/381	720/327.3
54/1372	64/1626	64/1626	15/381	790/359.1
62/1575	72/1829	72/1829	15/381	910/413.6
70/1778	80/2032	80/2032	15/381	1080/490.9
78/1981	87/2210	87/2210	15/381	1230/559.1
88/2235	95/2413	95/2413	16/406	1400/636.4
96/2438	103/2616	103/2616	16/406	1560/709.1
108/2743	115/2921	115/2921	16/406	1800/818.2
120/3048	127/3226	127/3226	16/406	2080/945.5

From this table we select relation between diameter D2 and width W specified by Diameter and Depth respectively as

W= 0.16 × D2 ….(4.3)

1) Volume capacity (Q)

Q = 1/8 × π × (D22-D12) × Wt (4.4)

But, Q = maximum flow rate of steam = 1.11lit/sec.

In the above equation 't' is the time period between entry of steam to porous hole and exit of steam from it, assuming steam to be condensed through total length i.e. width of wheel. Time required covering distance from point A to point B (t)

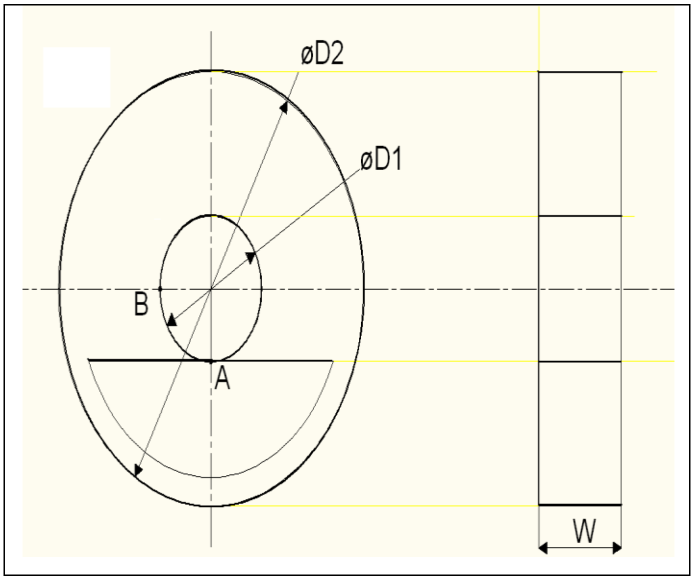


Fig. 4.2 Design Parameters showing Arc (AB)

Speed of wheel = 2 rpm to 20 rpm, Speed range is given by "Cadant-Johnson" Heat Wheel.

As design for any speed between above range is correct but selection of speed depends on standard gear box available or standard geared motor available.

Standard geared motors are of 3.5rpm, 30rpm, 100rpm etc.
Thus, Speed (N) = 3.5rpm motor is directly coupled to shaft of wheel.

Peripheral velocity (V):

$$V = \frac{\pi \times D1 \times N}{60} \qquad (4.5)$$

$$\therefore\ V = \frac{pi \times 60 \times 3.5}{60}$$

$$\therefore\ V = 10.99 \text{ mm/sec.}$$

Now, time $(t) = \frac{Arc\ (AB)}{V}$

$$Arc\ (AB) = \pi/4 \times D1 = \pi//4 \times 60 = 47.12 \text{ mm.}$$

$$\therefore\ t = 47.12/10.99$$

$$\therefore\ t = 4.28 \text{ sec.}$$

Thus, from eqn. 4.4,

$$Q = 1/8 \times \pi \times \frac{(D22-D12) \times W}{t}$$

$$\therefore\ \frac{1.11}{103} = 1/8 \times \pi \times \frac{(D22-0.0602) \times 0.15 \times D2}{4.28}$$

By trial and error method.

$$\therefore\ D2 = 0.296 \text{ m}$$

$$\therefore\ D2 = 300\text{mm.}$$

Now, W = 0.16 × 300 = 48

Rounding up,
$\therefore$ W = 50 mm

2) Porous Diameter (d)

It can be determine by considering following theories,
Theory of capillarity
Theory of porosity of wheel.

i) Theory of Capillarity

As the condensed steam passed out through porous hole or tube of wheel by capillary action. This consideration is important for selecting diameter (d).

For capillary action diameter should be less than 6 mm.

Suitable range of diameter = 0 to 6 mm.

$$\text{Average Diameter, } d = \frac{0 + 6}{2}$$

$$\therefore\ d = 3 \text{ mm.}$$

ii) Theory of Porosity

By this theory we can find diameter of porous hole considering porosity of heat wheel. The standard range of porosity is 85% to 93%. We can take average value 89%.
Figure 4.3 shows the typical segment of porous hole due to corrugation of Alluminium sheets.

It shows that two holes occupy the area equal to two times area of square of length d (i.e. diameter of porous hole)

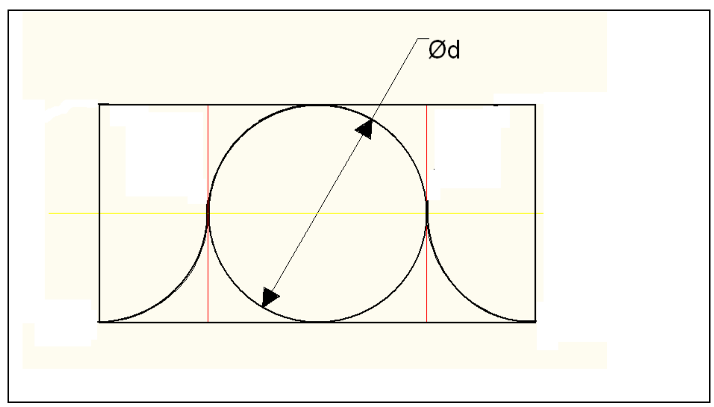


Fig. 4.3 Porous Diameter of Wheel

Let A1= area of square excluding thickness of sheet.
A2= area of square including thickness of sheet.
t= thickness of sheet.

From figure 4.3,

$$A1 = 2(d+t)2 - \pi dt$$

$$A2 = 2(d+t)2$$

$$\text{Porosity} = \frac{A1}{A2} = \frac{2(d+t)2 - \pi dt}{2(d+t)2} \qquad \ldots..(4.6)$$

$\therefore 0.89 = 1 - \frac{\pi \times d \times 0.32}{2 \times (d+0.32)^2}$

By trial and error,

d = 3.1mm

$\therefore$ d = 3mm

4.3 Design of Ordinary/conventional Heat Exchanger (Plate Type)

The conventional heat exchanger is to be design for the same capacity as that for heat wheel. Similarity between the heat wheel and conventional heat exchanger,

1) Material- Alluminium.
2) Thickness of Sheet- 0.32mm.
3) Wetted area of heat wheel= Wetted area of conventional heat exchanger.

Wetted area of heat wheel can be found out by using arithmetic progression method.

Let a- Circumference of Hub.
an- Circumference of heat wheel.
n- No. of corrugated surfaces.
d-Common difference between successive circumferences.

Now, n= (300-60)/ (3×2) = 40.
a= π × 60= 188.5 mm.
an = π × 300= 942.5 mm.

But, an = a+ (n-1) × d.
$\therefore$ 942.5=188.5 + (40-1) × d
$\therefore$ d= 19.33 mm.

Now, Sum of all circumferences,

$$S = (n/2) \times [2\times a+(n-1)\times d] \quad (4.7)$$

=(40/2) × [2× 188.5 +(40-1) × 19.33]
=22617.4 mm.

Plane length = s

Corrugated length = π × (s/2) = 35526.7mm.

Total length = plane length + corrugated length
=22617.4 +35526.7
= 58144.1mm.

Total area of heat wheel = Total length × w.
= 58144.1 × 50
= 2907205mm2 = 2.9m2

Wetted area = 2.9/2=1.45m2

Dimensions of Plate Type Heat Exchanger

In case of conventional heat exchanger condensate is taken out by gravity hence capillary action should be avoided (width of plate should be greater than 6mm).Taking into manufacturing consideration the suitable width to be 10mm.

For symmetry, assume b=h.
Area, A= (2b + 2× 0.01) × h.
Take no. of plate =8.
Wetted area one plate = 1.45/8
= 0.180 m2
$\therefore$ (2b + 0.02) × b=0.180
$\therefore$ $2b^2 + 0.02b - 0.18=0$

Solving,

b= 0.295 m= 300 mm
b=300mm.
And h=300mm.

4.4 Design of supporting Members of Heat Wheel

The shaft and Bearings have been selected as available in standard dimensions. The axle of bike as shaft and suitable bearing is used.

Shaft diameter = 12mm,

Bearing selected is 6201, because shaft diameter and core diameter are same as 12mm.

Now our aim is to check safety of shaft and bearing under loading and operating condition.

4.4.1 Shaft

Shaft supports the heat wheel, which is rotated by motor having

Power - 6 watt
Speed - 3.5rpm.

According to A.S.M.E code of design the maximum shear stress induced in the solid shaft subjected to the combined torque and bending is given by,

$\tau_{max} = (16\times T_e)/(\pi\times d^3)$

Where Te= equivalent twisting moment.
d= diameter of shaft, 12mm.
τ_{max} = maximum shear stress.

According to A.S.M.E code the value of allowable shear stress τ_{all} are given as

For commercial steel shafting:
τ_{all} = 55 N/mm2
For purchased under specification:
τ_{all} = 0.3Syt or 0.18 Sut whichever is minimum.

Now overall arrangement is as shown in figure 5.4

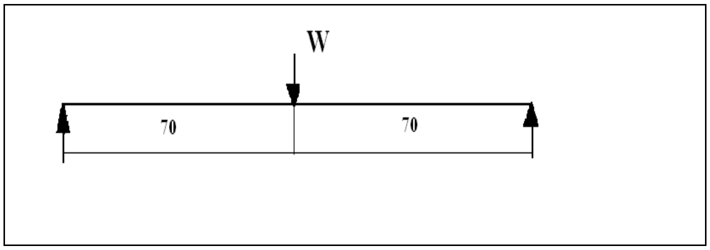


Fig. 4.4 Simply Supported Beam with Centre Load

For gradually applied load combined shock factor (Kb) and fatigue factor (Kt) are given as 1.5 and 1.0 respectively.

Now torque transmitted by shaft is given as,
T = (60×P)/(2πN)
. ˙ . T = (60×6)/(2×π×3.5)
. ˙ . T=16.38×103 N-mm.

Weight of heat wheel can calculated as follow,

W = (1- porosity) × Volume × Density
. ˙ . W =(1-0.89) × π/4×3002 × 50 × 2800 × 10-9
. ˙ . W =1.3854kg
. ˙ . W =13.5912N.

Maximum bending moment for centrally loaded shaft is given as,

M = W×L/2.

Here,
W = 13.591N
L = 140mm.

Hence,
. ˙ . M = 13.5912 × 140/ 2.
. ˙ . M = 951.38N-mm.

Now,
Equivalent bending moment is given as,
Te= √ ((Kb×M)^2+(kt×T)²)
. ˙ . Te = √ ((1.5×951.38)2+(1×16.37×103)²)
. ˙ . Te =16.432×103 N-mm.

Maximum shear stress induced in shaft is,
τmax = (16×Te)/(π×d3)
. ˙ . τmax = (16×16.432×103)/(π×123)
. ˙ . τmax = 48.43 N/mm2.
Which is less than τall = 55 N/mm2

Hence the shaft is safe under combined torque and bending moment.

5. MANUFACTURING ASSEMBLY

6. TESTING

6.1 Precautions

1) All the electric connections should be proper.
2) Proper water level should be maintained inside pressure cooker to avoid overheating.
3) Both air and seam carrying ducts and pipes should have leak-proof joints.
4) Pressure inside the pressure cooker should not rise beyond designed limit.
5) Both the steam and air compartments should be properly sealed.
6) There should not hand touch to steam pipe.
7) Attachments of all thermocouple should be proper.

6.2 Procedure

1) To Check Purity of Water.
2) To fill proper quantity of water inside the pressure cooker and keep it on heater.
3) Keep the valve closed.
4) Switch on heating coil and wait till steam formation starts.
5) Once the dead weight valve indicates pressure is being developed inside the cooker, switch on motor of heat wheel and fan.
6) Slightly open the valve and maintain full flow rate of steam.
7) Switch on temperature indicator.
8) Wait for some time to achieve thermal equilibrium.
9) Take the readings as,
a) Temperature of the steam.
b) Pressure of steam.
c) Inlet temperature of air.
d) Outlet temperature of air.
e) Air velocity at outlet.
10) Switch OFF heating coil, motor and fan.
11) Then connect pressure cooker outlet to conventional plate type heat exchanger and switch ON fan.
12) In the same way as previous supply the steam to conventional plate type heat exchanger at the same flow rate.
13) Take the readings as above.

14) Switch OFF heating coil, fan and temperature indicator.

6.3 Observations and Observation Table

Observations

1) ID of fan = 60mm.
2) OD of fan = 120mm.

Observation Table

Sr. No.	Pressure (bar)	Temperature of Steam (^{0}C)	Temperature of Air (^{0}C) I/P	Temperature of Air (^{0}C) O/P	Air Velocity (m/sec)
1 (For Heat Wheel)	1.01325	92	35	44	4.0
2 (For Conventional Heat Exchanger)	1.01325	92	35	40	4.0

6.4 Calculations

6.4.1 Mass flow rate of air (ma)

Qa = A × V
Here, A= (π/4) × (1202 - 602) = 8482.3mm2.
V= 4 m/sec.
∴ Qa = 8482.3 × 4 × 103 = 33.93 × 103 mm3/sec = 33.93 × 10-6 m3/sec.

∴ ma = ρ × Qa
ρ of air at 350 = 1.1465 kg/m3
ma = 1.1465 × 33.93 × 10-6
ma = 0.0389 kg/sec.

6.4.2 Effectiveness (ε)

i) For Heat Wheel
ε = (Ta2-Ta1)/ (Ts-Ta1)
= (44-35)/ (92-35)
ε = 15.79%

ii) For Conventional Heat Exchanger
ε = (Ta2-Ta1)/ (Ts-Ta1)
ε = (40-35)/ (92-35)
ε = 8.77%

6.4.3 Efficiency

i) For Heat Wheel:
Heat Supplied To Steam = 1.8 kW.
Heat absorbed by air = ma × Cp × dT
Temperature Difference= (Ta2- Ta1)
= (44-35)
= 9 0C

Cp = 1.005 kJ/kg0k.

∴ Heat absorbed by air = 0.0389 × 1.005 × 9
= 0.3519 kJ/sec.

EfficiencyHeat Wheel = Heat absorbed by air × 100
. Heat Supplied To Steam
= 0.3519/ 1.8 × 100
∴ EfficiencyHeat Wheel = 19.54%.

ii) For conventional Heat Exchanger:

Heat Supplied To Steam = 1.8 kW.
Heat absorbed by air = ma × Cp × (dT)
Temperature Difference= (Ta2- Ta1)
= (40-35) 0C
= 5 0C
Cp = 1.005 kJ/kg0k.

∴ Heat absorbed by air = 0.0389 × 1.005 × 5
= 0.1955 kJ/sec.

EfficiencyCHE = 0.1955/ 1.8 × 100.
∴ EfficiencyCHE = 10.85%

7. RESULT AND DISCUSSION

7.1 Result table

Sr. No.	Particular	For Heat Wheel	For Plate Type Heat Exchanger
1	Effectiveness	15.79 %	8.77 %
2	Efficiency	19.54 %	10.85 %

7.2 Discussion

From the above table we can say that heat wheel is more effective and efficient than conventional plate type heat exchanger. Actually results shown are far away from actual values that should be. It is because the setup has most of parts are standard which have been used as per their ease of availability in market. But these parts are not feasible with each other hence readings are not actual, However effectiveness and efficiency of heat wheel is better than conventional heat exchanger.

CONCLUSIONS

From this project we can conclude that, global shortage of energy sources can be overcome by using heat wheel to recover wastage of heat in industries. As Heat wheel is more effective it is more suitable to use as rotary heat exchanger. From the results we can say at least 15% of heat can be saved. In future it has wide scope only more feasible design will have to be adapted.

As seen in previous chapter heat wheel can condensed steam, it can be used as cogenerator for process heating. Simply it replaces the condenser and thus reduces large water requirement for condensation with recovery of waste heat. It means heat wheel gives couple of advantage simultaneously. Therefore it has wide scope in future for power plant and process industries application.

ACKNOWLEDGEMENTS

We are very grateful for all the help, support and encouragement we have had during the writing of the paper & designing the project from our teachers. Special thanks to our guide Prof. Shelke D. B. for their continuous help and technical guidance. We are also thankful to Prof. Khot sir, Head of mechanical engineering department for their technical support. We also thank our classmates and friends for their continuous support while completion of the project