meng 262– Fluids & Heat Transfer

Lab 1 – Create Your Own Pump Curve and Examine It September 2016

Purpose

Create your own pump characteristic curve and examine it.

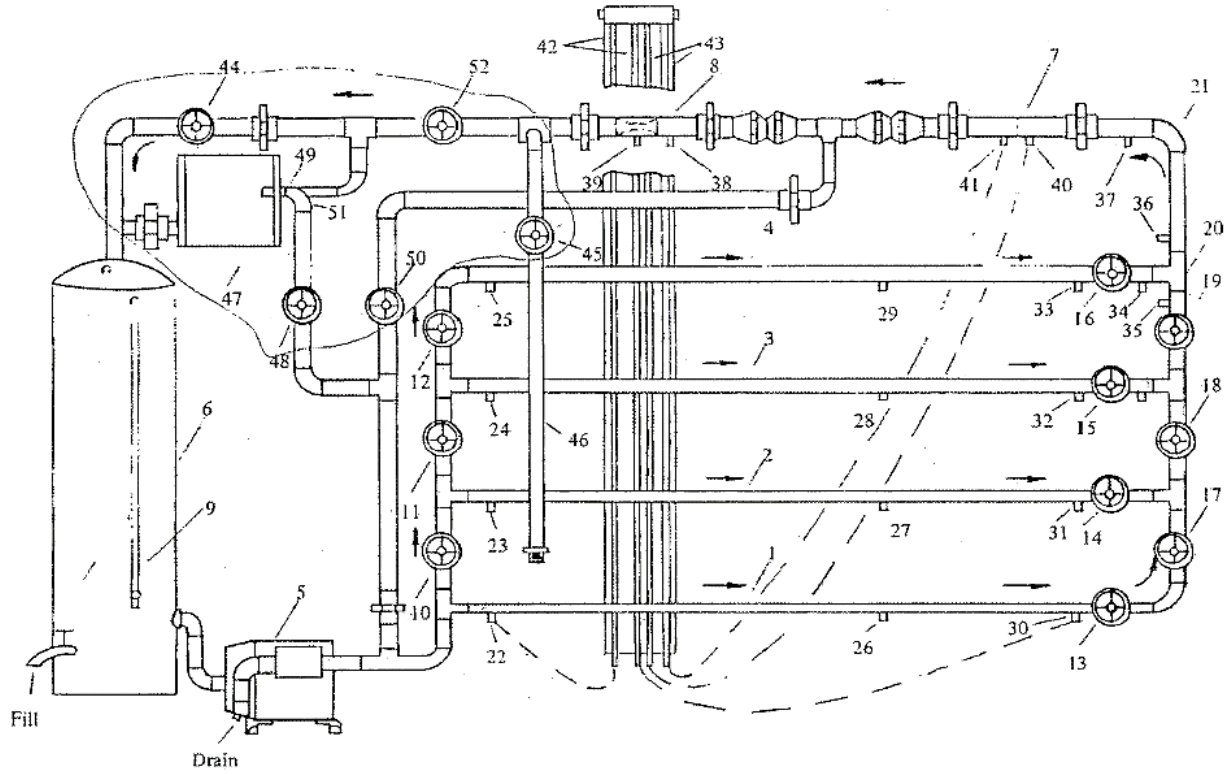
Apparatus

The 'Scott Apparatus' located in TEC 106.

Procedure

i. Examine the Scott Apparatus in TEC 106 and become familiar with the:

- Tank
- Pump
- Flow paths and overall flow routing
- Sharp Edged Orifice Flowmeter
- Manometers.
  What are the units of measure used on the vertical scales?
- The pressure gauge and where it is connected into the system.
  How high above the centreline of the pump is the pressure gauge needle centre?



ii. Play with the system a little bit.
Please don't mess it up.

iii. Adjust the valves so that water circulates **only** along the branch that includes ports 25 and 33.
Close off the other parallel pipe paths.

iv. Find and use **valve 52** as your flowrate adjustment.
Note which valve you have chosen.

v. Examine the various head measurement possibilities and figure out how to measure the head added by the pump, h_A.
To do the is you will need:
- Head at or near the pump inlet; and,
- Head at or near the pump discharge.

vi. Examine the 'Sharp Edged Orifice' flowmeter and observe how it is tied into the manometers.

Use it to measure the flowrate in the 1", Type K, Copper pipe it is installed into.

Use: $h_{40/41} = K\left[\frac{v^2}{2g}\right]$; where $K = 12.85$ to determine the velocity from your h measurements.

vii. Systematically adjust the flow control valve. After each adjustment measure:
- $h_{PUMP\ INLET}$ (tape measure: tank water level to pump centre line)
- $h_{PUMP\ DISCHARGE}$ (pressure gauge reading adjusted for elevation)
- h_{40} (read this) as relative to …
- h_{41}

viii. Once your measurements are taken, for each adjustment point, calculate:
- v, flow velocity, m/s
- $\dot{Q}$, volume flowrate, L/s
- h_A
- Using Excel, plot the pump characteristic curve for the pump attached to the Scott Apparatus.
  (That's a graph of h_A vs $\dot{Q}$)

ix. Using the theoretical pump power input required equation (available in your textbook), determine the input shaft power at each of your data points. Create of new plot of Theoretical Pump Input Power vs Flowrate on your Excel page.

x. Comment:
- Does the pump characteristic curve look the way you would expect?
  What is your basis of comparison? Sketch the shape of curve you expected to see and consider why the experimental one is different.
- Does the pump input power curve look different than you expected? Is there a maximum and are there minimum points? Why is the curve shaped as it is?

xi. Present your work in a short but complete report that clearly lays out:
- What you did (procedure)
- What raw results you obtained (no calculations or interpretation here)
- What calculated results you obtained
- What comments you have (discussion)
- (No conclusion necessary)