

MIDTERM REPORT FOR IPRO 314 KOLFF'S ROTATING DRUM ARTIFICIAL KIDNEY

The class has divided itself into 4 operating teams and 1 special team:

Rotating Drum
Axle Assembly
Stand and Basin
Blood Pump

Design Team made up of CAD-trained students

The first part of the semester had a steep learning curve as students learned the difficulties associated with reading 2D blueprints from 1946. Secondly, there are no specifications other than dimension. There are no details discussed or illustrated except in photographs. Therefore, determining exactly how things work and are related has been the main task. However, construction has actually begun in the last week for the Drum and Stand/Basin Teams. These two teams have the primary task of construction this semester. The others are focusing on design and perhaps first iteration manufacturing since their's are fairly sophisticated. The team reports follow.

Midterm Report for Rotating Drum Group

Team Members: Mary Hannink, Aaron Whiting, Jennifer Barta, Rebecca Hannah

The drum group's objectives are to research and determine the design and specifications of the components of the rotating drum, and then assemble the drum. Currently, the group is focused upon learning more about the parts of the drum, figuring out where to order parts from, and determining how specific parts were constructed. Construction of the wooden slabs that run along the circumference of the drum has begun, and more effort towards the physical construction of the drum will take place as more is understood about the drum. To date, we have researched sausage casing for the dialysis membrane and ordered some to test. We also have researched wood lacquer, the dimensions of the drum, the number of wooden slabs needed, and have looked into the wheel piece that fits around the axel.

In the next few weeks, the group will focus on the design and construction of the wheel component which will connect to the axel. Once the design is verified, the group will find the tools necessary and construct these components. During this time period, several tests will be conducted upon the sausage casing. We will test the casing for degradation by leaving it in water for at least a month to see if it will be a useful material for display purposes. Another test will be to see if it functions as a semi-permeable membrane using a basic dialysis setup. Lastly, the group will have to determine the best way to prepare and treat the casing, as it currently is tightly

packed, wrinkled, and possible leaky. Another future task will be the cutting of the wooden slabs to the appropriate shape and dimensions.

Currently, the only obstacles facing the group are a lack of tools necessary to make some of the parts, which may be resolved by visiting Rebecca's house in Missouri to use her father's tools. Otherwise, it is simply a matter of time before we complete our objectives, until future unforeseen obstacles or challenges arise.

Midterm Report for Coupling and Axle Group

Team Members: Ryan Jungels, Abhi Das, Niekoo Abbasian

Revised Objectives:

It is the goal of the group to have produced a coupling and axle by the end of the semester. This coupling and axle should be modeled after the initial blueprints found in the Kolf book and tolerated to necessary precision in order to have the parts function as intended. The design will also be analyzed in respect to its biomedical significance. How and why it works.

Results to Date:

- Blueprints have been transposed into 3-D model in ProE
- 2-D plots have been created in INVENTOR
- Research and speculation has been done on questionable features such as the cotton and Vaseline packing and the tube connections
- Research has been started on the biomedical functionality of the design

Revised Task/Event Schedule:

Oct 30	1 st trip to machine shop
Nov 11	Assembly and testing
Nov 11	Completed biomedical research
Nov 20	2 nd machine shop visit (if necessary)
Dec 2	Fine tuning and adjustments
Dec 2	2-D drafts for museum
Dec 2	3-D animation for museum?
Dec 2	Finished biomedical report for museum

Updated Assignments:

Ryan: Machine shop visits and completion of any drafting/modeling

Abhi: Assembly and machine shop assistance, research into functionality of design and biomedical applications

Niekoo Abbasian: In charge of researching the physiological significance of the axle and its components as well as background information on kidney dialysis treatments; also be in charge of understanding the significance of the artificial kidney and its role in medical technology

Barriers and Obstacles:

- Unclear dimensioning on original blueprints
- No specification of threading
- Lack of description of the location of the cotton and Vaseline packing
- No description of the functionality of small holes on axle
- Differences between pictures of the machine and the blueprints

Midterm Report for Stand and Basin Team

Team members: Sam Vazquez, Brendan Inouye, Tim Britt

The primary project goal is to recreate the stand component of Dr. Wilhelm Kollf's rotating drum dialysis machine.

Stand and Basin Team Methods

All background information has been provided in the form of Kollf's 1946 publication, *The Artificial Kidney*.

Stand and Basin Team Assignments

Currently, Autocad recreations of the original blueprints have been completed. Multiple coating options, to protect the machine have been investigated and the best option has been chosen. Fabrication options to build the stand have been investigated. Currently, an independent company is being considered to fabricate the stand to the desired specifications. Wood, to make the wooden slats, has also been collected for the rotating drum team.

The concentration of the team will be to complete a stand by the end of the semester. Other goals for the rest of the semester are to begin work on the basin and to begin to investigate the specifics on the heating element, and clot catcher associated with the basin.

Barriers and Obstacles

One of the major obstacles that were encountered thus far has been mainly finding a cost effective company which provides a ceramic coating process or an equivalent alternative.

Another obstacle which has been encountered has been the time needed to gather the necessary information to even be able to request quotations from companies.

Midterm Report for the Blood Pump Team

Team Members: Joe Sutalo, Justin Ram, Shawn Stumph, Michael Turturro

Joe has been working on the autocad designs and has them and has about 2/3rds or so of the way done. We faced a major setback in that the design team did not give him any of the designs they were supposed to have, so I believe he is doing those by himself. Justin, Shawn, and Michael have been working on getting the proper flow rates down for the inside of the pump, as well as some other little design issues. Justin has have also been working on a design for the website.

REVISED OBJECTIVES:

Originally the blood pump group did not intend to have any machine work done on the parts until next semester due to the high cost of machining needed to be done. However, a machine shop was appropriated to contract the work for free provided that IPRO group members do the work on the machines. At this time, a partial prototype should be available by the end of the semester.

RESULTS TO DATE:

- a. Approximate sprocket sizes were determined
- b. Mechanical arrangement of system was determined
- c. Tolerances were interpolated from original drawings
- d. Flow rates approximated

REVISED TASK/EVENT SCHEDULE:

- a. Machining to begin by November 11th, expected to continue throughout the semester
- b. Tubing sizes and sprocket sizes to be finalizes after prototype is machined

UPDATED ASSIGNMENTS:

- a. Assignments did not change

BARRIERS AND OBSTACLES:

- a. Little or wrong information on original drafts of blood pump
- b. Original artificial kidney was unavailable to reference
- c. Speed of blood pump is merely a guess due to inaccuracy of drafts and lack of dimensioning and callouts