HIGHER TECHNICAL INSTITUTE

MECHANICAL ENGINEERING DEPARTMENT

DIPLOMA PROJECT

DESIGN AND CONSTRUCTION OF A MICROMANOMETER

M. 824

BY: MICHAEL PANAGIOTIS

JULY 1998

DESIGN AND CONSTRUCTION OF A MICROMANOMETER

By

Michael Panagiotis

Project Report

Submitted to

The Department of Mechanical Engineering

HIGHER TECHNICAL INSTITUTE

Nicosia – Cyprus

In Partial Fulfillment of the Requirement

For the Diploma of

TECHNICIAN ENGINEER

IN

MECHANICAL ENGINEERING

June 1998

Acknowledgements

I would like to express my sincere thanks to Dr. Polyvios Eleftheriou for his valuable assistance and guidance given to me throughout this project.

My special thanks also go out to my friends and everyone that gave me advice and help.

Dedication

This project is dedicated

To my family

And my fianceè

For having offered me so much.

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Summary

The aim of this project is to design and construct a micromanometer capable of measuring a head of ± 30 cm, with the resolution of 0,01mm.

In the procedure of this project, basic themes and definitions of manomatry were studied. Manual and experiments were performed. Also, the design for the main components which may fail were made. Special attention was given to the bearing life. Estimation of the cost of the micromanometer was performed and includes direct material costs, labour cost, subcontracting and overheads.

All the above are included in this project with the relevant work drawings.

Introduction

The science of fluid began with the need to control water for irrigation purposes in ancient Egypt, Mesopotamia, and India. Although these civilizations understood the nature of channel flow, there is no evidence that any quantitative relationships had been developed to guide them in their work. It was not until 250 B.C. that Archimedes discovered and recorded the principles of hydrostatics and floatation. Although the empirical understanding of hydrodynamics continued to improve with the development of fluid machinery, better sailing vessels, and more intricate canal systems, the fundamental principles of classical hydrodynamics were not founded until the seventeenth and eighteenth centuries. Newton, Daniel Bernoulli, and Euler made the greatest contributions to the founding of these principles.

Classical hydrodynamics, though a fascinating subject which appealed to mathematicians, was not applicable to many practical problems because the theory was based on inviscid fluids. The practicing engineers at that time needed design procedures which involved the flow of viscous fluids; consequently, they developed empirical equations which were usable but narrow in scope. Thus, on the one hand, the mathematicians and physicists developed theories which in many cases could not be used outside the limited range of application from which they were derived.

Near the beginning of the twentieth century, however, it was necessary to merge the general approach of the physicists and mathematicians with the experimental approach of the engineer to bring about significant advances in the understanding of flow processes. Osborne Reynolds' paper in 1883 on turbulence and later papers on the basic equations of motion contributed immeasurably to the development of fluid mechanics. After the turn of the century, Ludwig Prandtl proposed the concept of the boundary layer. This concept not only paved the way to sophisticated analyses needed in the development of the airplane but also resolved many of the paradoxes involved with the flow of a low-viscosity fluid.