DESIGN, CONSTRUCTION, AND CALIBRATION OF A SMALL SUBSONIC WIND TUNNEL

by

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TABLE OF CONTENTS

THIS BOOK CONTAINS NUMEROUS PAGES WITH DIAGRAMS THAT ARE CROOKED COMPARED TO THE REST OF THE INFORMATION ON THE PAGE.

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LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

The purpose of this thesis was to design, build, and test a small subsonic wind tunnel that could be used in class laboratory work, aerodynamic experiments, and convection heat and mass transfer experiments. Although not a monumental task, the problem was to build a tunnel with a minimum test section velocity of 100 ft/sec, to include a test section of sufficient size that conveniently sized experiments may be carried out, and to make use of the unused 10 horsepower centrifugal fan that was available in the Mechanical Engineering Department.

The design method was to use proven designs as much as possible and to use proven design procedures for the remainder. It may seem that this design method prevents imagination in the design of the wind tunnel. However, this is not the case. Several special features were incorporated into this wind tunnel without violating proven design procedures.

Special features of this wind tunnel include slots in the settling chamber for screens for turbulence level control, a flow regulator to adjust the rate of flow through the test section, and casters to make the whole tunnel portable. Another important feature of the wind tunnel is the versatile test section. The test section contains two parts that are easily separated and removed. In this way either one or both parts or even a different test section may be used. The test sections are also easily

disassembled, allowing plexiglass sides and/or a floor with experimental apparatus to be installed. Also the test section is supported only at the ends; thus there are no obstructions that would get in the way of experimental equipment attached to the test section.

After design and construction were completed the system was tested to determine velocity ranges and velocity uniformity. Stevenson[1] stated that a velocity deviation of ±2.0% or less was sufficient for a wind tunnel of this nature. Thus a velocity deviation of ±2.0% or less from centerline velocity was the goal for this tunnel.