PART I

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PART 1

INTRODUCTION

1.1 BRIEF HISTORY OF PROBLEMS ASSOCIATED WITH STEAM WETNESS

The problems of wet steam are almost as old as steam turbines. Why ?

At any time during the early history of steam turbine development there existed, as we all know, an upper limit of live-steam temperature compatible with the strength of available and reliable structural materials. This temperature limit barred the most straightforward way of increasing the efficiency of steam turbine plants. It was therefore natural that steam turbine designers tended from early days to increase the efficiency (i.e. to raise the mean temperature level $\bar{T}$ of heat addition in the boiler) by increasing the turbine admission pressure p_o, as illustrated in Fig. 1.1.1, (a) and (b). It turned out soon however that limits were set for p_o, too. Astonishingly, the limits on live-steam pressure were not set by the high-pressure, high-temperature parts of the boiler or of the turbine; they were rather set by the fact that the wetness fraction $1 - X_E$ at the turbine exit increased, parallel with p_o, to dangerous levels.

With increasing the exit wetness, two problems were encountered. First, severe erosion was found to occur in the blading at the low-pressure end of the turbine. After a few months or few years of service, the low-pressure moving blades were damaged (roughened, pitted or even mutilated) and had to be replaced. In order to avoid grave erosion damage, a limitation of exit wetness to about 12 percent became and remained compulsory, even though considerable improvements in design and construction were made as