The percussive drilling of quartzite

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CONTENTS

PART I

PART II

PART III

INTRODUCTION

In South African gold mines some 100 million tons of rock are broken each year by drilling and blasting. Only minor improvements to this method of rockbreaking have been made since the general introduction of pneumatic rockdrills for stoping 50 years ago and, more recently, of drillsteels tipped with tungsten carbide.

The combined total cost of drilling and blasting amounts to almost R0,50 per ton of rock broken, which is just short of one quarter of the direct cost of stoping or development. Rockdrilling accounts for about R0,25 of the total cost of rockbreaking, of which R0,12 represents labour costs and R0,13 the cost of drillsteels, rockdrill spares and power. Mine air compressors use over 7×10^8 kWh of electric energy a year, amounting to 7 percent of the total electric power used by the gold mining industry.

The efficiency of percussive rockdrilling is, therefore, of considerable significance to mining costs. Over the past four years the Mining Research Laboratory of the Chamber of Mines of S.A. has been engaged in experimental studies of percussive drilling. These experiments were conducted at test sites on Robinson Deep Gold Mine and Vlakfontein Gold Mine, made available by Gold Fields of South Africa, Limited. Three rockdrills, designated types A, B and C, of different manufacture, were used in the experiments which involved the measurement of the following operating characteristics:

1. Throttle air pressure
2. Applied thrust
3. Penetration rate
4. Air consumption
5. Blows per minute
6. Drill steel revolutions per minute.

The results of these investigations are presented in three parts.

Part I, "The theory of percussive rockdrill operation" which provides a concise, mathematical description of the performance of a percussive rockdrill in terms of its principal mechanical dimensions and operating conditions, and an analysis of the bit and gauge wear of drillsteels.

Part II, "Measurements of percussive rockdrill performance" in which the experimental results are presented in terms of thrust-penetration rate curves at different throttle air pressures and throttle pressure-air consumption curves, which are shown to agree well with the predictions of theory. In addition, data relating gauge wear on the drillsteel and penetration rate to the distance drilled are discussed.

Part III, "Practical implications" in which an analysis of the status of thrusting devices is made and the benefits that would derive from using uptimum thrusts are discussed.

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