OPTIMAL DESIGN OF ELECTROMAGNETIC PULLEYS WITH MAXIMAL MAGNETIC EXTRACTION FORCE

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Summary. It is displayed that there is a possibility to considerably increase the extraction forces of serial electromagnetic pulleys. The new criteria of their optimization are offered. The results of standard sized pulleys calculation are produced. It is shown that starting from a particular value of extraction depth calculated parameters of the electromagnetic pulley with maximal extraction force do not change.

Key words: electromagnetic pulley, optimization, new criteria.

INTRODUCTION

Electromagnetic pulley separators are most economical magnetic separation devices for belt conveyers of granular materials since they are used not only as magnetic separators but as head pulleys of belt conveyers. The main function of electromagnetic pulleys as magnetic separation devices is the extraction of unwanted metal from granular medium on the belt conveyer with the purpose of production corresponding technological equipment from hitting this metal.

PROBLEM STATEMENT

The construction of magnetic separator of pulley type (electromagnetic pulley), which is widely used in industry, is shown in fig. 1 [1]. Traditionally the geometrical and electric parameters of the electromagnetic pulley are calculated in a way to ensure producing of the given value of specific reduced extraction force H_0 grad H_0 (here H_0 is intensity of the pulley magnetic field) in some given distance from the surface of the pulley poles and above the middle of interpolar gap. However, necessity of development of multipurpose pulleys for magnetic separation of different materials requires production of such electromagnets, which would produce maximal extraction force within given dimensions.



Fig. 1. The construction of electromagnet of serial pulley separator

Nowadays the approved design procedure of geometrical sizes of the pulley magnetic system and electric parameters of its winding is developed enough. These parameters make it possible to produce a particular value of extraction force in the given distance from the surface of the pulley poles and above the middle of interpolar gap. It is the problem of synthesis of the pulley electromagnetic system. It solution is based on the joint solution of two equations (of magnetic circuit and heat balance). The result provides parameters of electromagnetic pulley with the given extraction force.

Thereby it is necessary to choose the best variant of construction of the designed pulley of all possible ones on the basis of some criterion. Such choice based on some criterion (target function) can be considered as the problem of optimal design. In the present work this problem is solved with the additional condition of extraction force maximization.

THE CRITERIA OF OPTIMALITY

Nowadays there is no single criterion of optimization for electrical devices, because of complication of their particular characteristics calculation. Therefore, it is suggested to use optimality estimation criteria for electromagnetic pulleys, based on aggregation of the generally accepted criteria of optimization of electromagnetic devices: cost of materials and power consumption. Thus, in order that these criteria characterize particularly the pulley magnetic separator, the indicated generally accepted