ELECTRIC MECHANISM; PART. I; SINGLE-PHASE COMMUTATOR MOTORS

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Trieste

SINGLE-PHASE COMMUTATOR MOTORS

ELECTRIC MECHANISM

PART I.

SINGLE-PHASE COMMUTATOR MOTORS

BY

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To

MY FATHER,

WITHOUT WHOSE ENCOURAGEMENT THIS
RESEARCH WOULD NEVER HAVE
BEEN COMPLETED.

PREFACE

Every reader of the current literature on single-phase motors must feel an impression of the artificiality of the present methods of study, and their remoteness from all physical conceptions of what goes on in these machines. When reading these articles one feels oneself in a mathematical world, quite apart from reality, and cannot help entertaining a conviction that there must be *some* simpler way of putting the matter. The writer has himself published articles of this artificial character, based on the old conceptions, but is obliged to admit that they are of very little practical help to the engineer, and give very little insight into the phenomena really taking place. It is needless to say that a clear understanding of the phenomena is a necessary preliminary to improvements in practical application.

It gradually became clear to the writer that a radically new departure was necessary, to eliminate, on the one hand, the complex analysis hitherto necessary, which quite prevents a clear grasp of the physical facts, and, on the other, to lead direct to the results the designer requires, without artificiality and circumlocution. We require a theory which can readily be reduced to a numerical form, not one that merely gives us vague general ideas and complicated formulas.

The present treatise is an attempt to supply this want. Whether successful or not, must be left to the reader.

One may compare the state of affairs in single-phase motor work at the present day to the state of affairs in poly-phase motor work before the discovery of the circle diagram about 1895. Reading old articles on the subject, published before that date, one is surprised that a problem which we know to be fairly simple could be treated in so complicated and unnatural a way. All these old methods have now been swept away, and the action

of the induction motor can now be explained in a clear and simple manner.

It is the same with the single-phase motor, and it is believed that the methods of the present volume furnish a ground-work on which a clear and simple general theory may be built up so as to be intelligible to any earnest reader.

It has been found necessary, as will be seen in Chapter III., which contains the fundamental principles of the methods employed, to abandon the phase diagram and build up a new vector diagram, in which the directions of vectors represent directions in space and not in phase. The volume may, therefore, present difficulties, owing not to the intrinsic complication of the subject, but to the novelty of the fundamental ideas. If, in writing on the subject of ordinary alternating current phenomena, it were necessary to assume the reader quite unacquainted with the ordinary phase diagram, and to develop it with all accompanying ideas and conventions from first principles, the simplest investigations would take on an appearance of complexity which is really quite foreign to them.

Yet this is what we have been obliged to do in the present volume, and any difficulties which the reader may find will probably be due, at least as much to unfamiliarity with the novel ideas involved, as to the real difficulties of the subject, which will be found sufficiently simple as soon as the reader has thoroughly grasped the principles of the methods which are used.

The development of a new method of alternating current analysis, independent of all others, with a suitable notation and conventions to accompany it, is no easy task, and has involved an amount of labour quite out of all proportion to the size of the volume. Yet, nevertheless, it may well be that points of difficulty still remain in the exposition, as well as unsolved problems. This is unavoidable in a new subject, and it is the author's hope that other writers may take the matter up and remove some of these difficulties.

The present volume may be expected to be useful to two classes of reader:—

(1) To those professionally interested in the type of machine with which it deals.

(2) To the advanced technical student and teacher.

Many technical colleges are equipped with a good supply of single-phase motors, but these are almost useless, because a comprehension of their action is quite outside the limits of an ordinary college course. By the methods given in the last chapter of the present volume, however, one may very readily plot curves of field distribution by direct experiment, without any knowledge of the theory of the subject, and, in this way, a very clear idea of their operation may be simply obtained. I have received material assistance in revising the proofs from my friends Messrs. F. M. Denton, R. T. Looser, and J. T. Irwin. I have also to thank the American Institute of Electrical Engineers for permission to reproduce a portion of my paper on the "Shunt Induction Motor" appearing in their Transactions for 1909.

F. Creedy.