DYNAMO DESIGN. ITS THEORY AND PRACTICE

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PREFACE.

The following pages presuppose a practical knowledge of the theory of electricity and magnetism. In this wise the book under notice can only serve supplementally to the many good treatises already dealing with the subject. The table of contents will show that it was the aim to furnish theoretical grounds for the choice of dynamo constants. Considerable matter will be found treated of for the first time, in a book of this compass, and it may be stated in passing that no excuse need be offered for employing the calculus notation. In the opinion of the writer this latter method is a *sine qua non* for all successful engineering work. Before actual examples in design are undertaken, a set of simple formulæ are evolved for determining the over-all dimensions of the carcase and the dynamo losses. The iron and copper losses of the armature are made to depend upon the slot dimensions, and for trial variations of the latter, tables are constructed showing the advantages or disadvantages of successive choices. It is by referring all losses to the unit peripheral surface of the net armature core that, it would seem, a better grasp of the relative loss weights is obtained. Much has been said about the incremental loss at full load. The evidence is that it is an iron loss and in the following a practical method of evaluation of this latter has been set forth. In an example an application of this formula is made and the influence upon the choice of air gap noted. The effect of the time load-factor upon the final choice of air gap is also shown. These latter are entirely novel views and it is hoped they may prove useful.

THE AUTHOR.

New York, September, 1905.

CONTENTS.

LIST OF SYMBOLS.

A = Cross section of annulus of field coil.
AB = Ampere-bars.
A = Ampere-turns.
B = Magnetic density.
B_a = Apparent magnetic density in teeth.
B_r = Real magnetic density.
c = Specific armature copper loss.
D = Diameter of armature.
D_c = Diameter of commutator.
E = Voltage.
e = Specific excitation loss. Sparking voltage.
e_l = Sparking voltage with lap winding.
e_w = Sparking voltage with wave winding.
F = Flux per pole.
f = Pole-pitch factor.
i = Specific iron loss.
i_s = Current density net in armature copper.
J = Current in amperes.
L = Axial end connection length of armature winding. Self-induction.
$L.M.T.$ = Length of mean turn.
l = Length of armature core.
$m = \frac{B_a}{B_r}$.
n = Specific iron loss increment. Number of armature slots.

p = Number of poles.
R = Revolutions per minute.
r = Tooth pitch ratio = $\frac{\text{tooth width}}{\text{tooth width + slot width}}$
S = Design coefficient.
s = Ratio of diameter at bottom of slots to diameter of armature.
T = Time constant. Time of commutation.
t = Specific teeth iron loss. Time. Turns per coil.
V = Volume.
v = Ventilating factor.
W = Watts output or input.
z = Tooth pitch.
$\sim$ = Frequency in cycles per second.
Δ = Current density (gross) in field copper.
Δ_b = Current density in brush per cm².
δ = Depth of air gap.
$\varepsilon = \frac{D}{p\,l}$
η = Efficiency
$\kappa = D^2\,l$.
Λ = Length of field coil mean turn.
λ = Depth of armature slot.
ν = Number of commutator parts.
ρ = Ratio of depth of slot to width of slot.
σ = Area of brushes.
τ = Pole pitch. Temperature.
φ = Copper factor.
ψ = Specific resistance of copper per cm³.