General Equations for Hooping Coil

Needle point impedance always made 2500 peak ohms at resonance.

\[ H = \text{Field Density} \]
\[ r = \text{coil radius} \]
\[ l = \text{coil length} \]
\[ \alpha = \text{angular velocity} \]
\[ T = \text{Torque} \]
\[ U = \text{Volts induced in \( N \) turn coil} \]
\[ Z = \text{Impedance} \]
\[ r_i = \text{Needle point radius} \]

\[ V = 2H \times r \times l \times 10^{-8} \]
\[ = 2Hr l \times 10^{-8} \]

Put \( 2Hrl = k \).

\[ T = 2HrlS \times 10^{-1} = kI \times 10^{-1} \]

\[ V = k \times 10^{-8} \]
\[ \alpha = \frac{V \times 10^{-8}}{k} \]

\[ I = \frac{V \times 10}{k} \]
\[ T = kI \times 10^{-1} \]
Mechanical impedance at needle point

\[
\frac{\gamma}{\alpha V_i^2} = 2500.
\]

\[
V_i = \sqrt{\frac{2500 \mu}{4 \times 2500}}.
\]

\[
\frac{\gamma}{\alpha} = \frac{k \mu \times 10^{-4} \times k}{V \times 10^8} = \frac{k^2 \times 10^{-9}}{R}.
\]

Impedance is maximum at resonance and looks like R.

\[
\frac{\gamma}{\alpha} = \frac{k^2 \times 10^{-9}}{R}
\]

\[
V_i = \sqrt{\frac{k^2 \times 10^{-9}}{R \times 2500}} = k \sqrt{\frac{k \times 10^{93}}{R}}.
\]

\[
= k \times 10^{-7} \sqrt{\frac{40}{R}}.
\]

Volts at resonance for normal recording level.

Normal needle velocity = 4.232 cm/sec

\[
K = \frac{4.232}{V_i}
\]

\[
V = k \times 10^{-8} = \frac{k}{V_i}
\]

\[
= \frac{k \times 4.232 \times 10^{-8}}{R \times 10^{7} \sqrt{\frac{40}{R}}}
\]

\[
= \frac{4.232 \times 10^{-8}}{ \sqrt{\frac{40}{R}}}
\]

\[
= \frac{4.732}{\sqrt{40}} \sqrt{R} = 0.671 \times \sqrt{R}.
\]

\[
= 6.71 \times 10^{-2} \sqrt{R}.
\]
Effective Electrical Capacity.

Let $M =$ moment of inertia.

Mechanical impedance $= \frac{Z}{K}$

$= \frac{R \times 10^{-9}}{Z}$

$Z = \frac{R \times 10^{-9}}{\frac{M}{\omega}}$

$= \frac{R \times 10^{-9}}{\omega M} = \frac{1}{\omega R \times 10^{-9}}$

$C = \frac{M}{R \times 10^{-9}}$ farads.

Effective stiffness to resonate at $\omega_0$ must give admittance to resonate $C$ at $\omega_0$.

$\frac{1}{LC} = \frac{1}{\omega_0^2}$

$L = \frac{1}{\omega_0^2 C} = \frac{R \times 10^{-9}}{\omega_0^2 M}$

Circuit then appears:

\[ \begin{array}{c}
R \\
C = \frac{M}{R \times 10^{-9}} \\
\end{array} \]

\[ \begin{array}{c}
\text{Replied } \frac{6.71 \times 10^{-1}}{\text{Volts}} \\
\text{Impedance correct.} \\
\text{R is resistance refers to a twin winding.} \\
R = 2 \text{ H Volts.} \\
\end{array} \]
Check when using following constants:

\[ H = 6000 \]
\[ R = 100 \]
\[ M = 0.486 \]
\[ v = 0.8 \]
\[ L = 1.0 \]
\[ A = 500 \]
\[ \omega_0 = 1570. (250\) \]

\[ k = 2HvL = 2 \times 6000 \times 0.8 \times 1.0 \times 500 \times 10^6 \]
\[ = 4.8 \times 10^6 \]
\[ (= 880k) \]

\[ k^n = 2.3 \times 10^{13} \]

\[ C = \frac{0.486}{2.3 \times 10^{13} \times 10^9} = 2.11 \times 10^{-4} \]
\[ = 21.1 \, \text{M} \]

\[ L = \frac{2.3 \times 10^{13} \times 10^{-9}}{1570^2 \times 0.486} = 2.3 \times 10^{-2} \]
\[ = 1.92 \, \text{mH} \]

\[ V = 6.71 \times 10^{-5} R = 6.71 \times 10^{-2} \times \frac{1}{100} \]
\[ = 0.671 \, \text{Volts} \]
A paper with the title "Characteristics of recorder with \( H = 6000 \) lines/sq in."

The table includes columns for frequency (\( f \)), output (\( \omega C \)), voltage (\( \frac{1}{C} \)), and some other values calculated from these.

The diagram shows a circuit diagram with values labeled as 14.3, 800, and 10,000.

The dates 26 Nov 1926 and 26 Nov 1927 are present on the top right corner of the page.
Approx. Characteristics of Recorder with \( H = 10,000 \) lines/sq.m.

\[
\begin{align*}
C &= 211 \times \left(\frac{1}{10}\right) \\
L &= 15.2 \times \left(\frac{1}{10}\right)^2
\end{align*}
\]

It is sufficient from characteristic point of view to consider \( R \) to be reduced to 36 w and use figures for 1000. \( R = 1800 \)

\[
\frac{V}{W} = R_{3.625}
\]

<table>
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<th>( f ) (Hz)</th>
<th>( Z^2 ) (ohms)</th>
<th>( Z^3 ) (ohms)</th>
<th>( 1/\sqrt{V/W} )</th>
<th>T.U.</th>
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