### Observation Table (Copper Strip)

<table>
<thead>
<tr>
<th>S.No</th>
<th>Resistance</th>
<th>Null Point $l_1$</th>
<th>Null Point $l_2$</th>
<th>$(l_2 - l_1)$</th>
<th>$P = R/(l_2 - l_1)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>0.1</td>
<td>43.5</td>
<td>48.2</td>
<td>4.7</td>
<td>0.0212</td>
</tr>
<tr>
<td>2.</td>
<td>0.2</td>
<td>42.2</td>
<td>50</td>
<td>7.8</td>
<td>0.0256</td>
</tr>
<tr>
<td>3.</td>
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<td>41.7</td>
<td>51.5</td>
<td>9.8</td>
<td>0.0306</td>
</tr>
<tr>
<td>4.</td>
<td>0.4</td>
<td>39.8</td>
<td>52.8</td>
<td>13.1</td>
<td>0.03053</td>
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<tr>
<td>5.</td>
<td>0.5</td>
<td>38.7</td>
<td>53.8</td>
<td>15.1</td>
<td>0.033</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.0281</td>
</tr>
</tbody>
</table>
Aim: To determine the resistance per unit length of a Carey Foster's bridge wire and also to find out the specific resistance of a given wire.

Apparatus:
- Carey Foster's bridge
- Decimal resistance box
- Battery eliminator
- Ammeter
- Copper strip
- Plug key
- Rheostat (nearly 10 to 20 ohm)
- Connection wires
- Jockey
- Given wire whose specific resistance is to be determined

Working formula

(a) Determination of the value of resistance per unit length of the bridge wire (R)

Carey Foster's bridge is based on the principle of Wheatstone's bridge and designed to measure small resistances. In this bridge, resistance of two adjacent arms are kept equal, and the balance point is obtained by adjusting the resistances of other two arms. Let the resistances of the other two arms be \( R = X + 8l_1 \) and \( S = Y + 8(L-l_1) \)

(Where \( l_1 \) is the distance from lift end of the bridge.
where balance point is obtained)

\[ X + 8l_1 = Y + 8(L-l_1) \]  (1)

Interchanging \( X \) and \( Y \), the equation will be

\[ Y + 8l_2 = X + 8(L-l_2) \]  (2)

(where \( l_2 \) is the balance point from the same side as before)

From eq. (1) & (2)
\[
Y = X - \frac{X}{(L_2 - L_1)}
\]

<table>
<thead>
<tr>
<th>S.No</th>
<th>Resistance</th>
<th>LSR</th>
<th>CSR</th>
<th>Diameter</th>
<th>Radius</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>43.2</td>
<td>10.8</td>
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<tr>
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<td>1.2</td>
<td>52</td>
<td>45</td>
<td>7</td>
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<tr>
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<td>48.7</td>
<td>48.5</td>
<td>0.2</td>
<td>1.49</td>
</tr>
</tbody>
</table>

Mean 1.0087

<table>
<thead>
<tr>
<th>S.No</th>
<th>LSR</th>
<th>CSR</th>
<th>Diameter</th>
<th>Radius</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>22</td>
<td>0.022</td>
<td>0.011</td>
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<tr>
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<td>0.021</td>
<td>0.0105</td>
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<tr>
<td>3</td>
<td>0</td>
<td>23</td>
<td>0.023</td>
<td>0.0115</td>
</tr>
</tbody>
</table>

Mean 0.011

**Calculations**

\[
\begin{align*}
S &= 0.0281 \\
Y &= 1.0087 \\
S &= 1.4 \times 10^{-5}
\end{align*}
\]
\[ X - y = s(l_1 - l_2) \]  \hspace{1cm} (2)

4 is kept zero by connecting the terminals with a copper strip and \( X \) is chosen to be \( R \). we have from, eq (3)

\[ s = \frac{R}{l_2 - l_1} \]

(b) Determination of the specific resistance of a given wire(s)

The resistance of the unknown wire is determined from the experimentally obtained \( y' \),

\[ y' = X - s(l_1 - l_2) \]

Where \( y' \) = Resistance of unknown given wire
\( X \) = known resistance

The specific resistance of the unknown given wire

\[ s = \frac{y' \pi r^2}{l} \]

where, \( r \) = Radius of the unknown given wire
\( l \) = length of the unknown given wire

Result
(i) The resistance per unit length of the bridge wire \( l = 0.0281 \)
(ii) The resistance of the given wire \( y' = 1.0087 \)
(iii) Specific resistance of the given wire \( s = 1.4 \times 10^{-5} \)

Precaution
(i) The cell circuit should be closed only when readings are being taken.
(ii) The readings should be taken from a single reference point
(iii) Plug key should be closed when observations are taken.

Teacher’s Signature: [signature] 14/6/11