CLAIMS

1. A hat-shaped steel sheet pile which is manufactured by cold working and is used for a temporary wall comprising:

a web;

a pair of flanges;

a pair of arms; and

a pair of joints,

the pair of flanges being formed at both ends of the web, an arm constituting the pair of arms being formed at an end of a flange constituting the pair of flanges, and a joint constituting the pair of joints being provided at a tip of the arm, wherein

the web includes a protrusion over an entire length of the steel sheet pile, and

the protrusion satisfies following expressions (1,), (2), (5), and (6),

[Mathematical Expression 1]

$$V \geqq B/16 \quad \cdots\cdots(1)$$

$$1.5 \leqq \frac{4.1}{\left(\left(\frac{B \times (H/B)^{0.1} \times \sqrt{\varepsilon_y}}{t + \frac{W \times V^{0.85} \times n}{B \times (H/B)^{0.1}}} \right)^2 - 0.25 \right)} \leqq 10 \quad \cdots\cdots(2)$$

$$V/H \leq 0.17 \quad \ldots \quad (5)$$

$$W/B \leq 0.34 \quad \ldots \quad (6)$$

where V: protrusion height (mm); W: width (mm) between protrusion bases ($W < 5 \times V$); n: number of protrusions; H: steel-sheet-pile cross-section height (mm); B: steel-sheet-pile web width (mm); t: plate thickness (mm) of steel-sheet-pile-web; and ε_y: yield strain of steel sheet pile.

2. A hat-shaped steel sheet pile which is manufactured by cold working and is used for a permanent wall comprising:

a web;

a pair of flanges;

a pair of arms; and

a pair of joints,

the pair of flanges being formed at both ends of the web, an arm constituting the pair of arms being formed at an end of a flange constituting the pair of flanges, and

a joint constituting the pair of joints being provided at a tip of the arm, wherein

includes a protrusion over an entire length of the steel sheet pile,

the protrusion is formed by being bent to protrude to an inner surface side or an outer surface side of the web, and

the protrusion satisfies following expressions (1), (3), (5) and (6),

[Mathematical Expression 2]

$$V \geqq B/16 \quad \cdots\cdots(1)$$

$$2 \leqq \frac{4.1}{\left(\left(\frac{B \times (H/B)^{0.1} \times \sqrt{\varepsilon_y}}{t + \frac{W \times V^{0.85} \times n}{B \times (H/B)^{0.1}}} \right)^2 - 0.25 \right)} \leqq 10 \quad \cdots\cdots(3)$$

$$V/H \leq 0.17 \quad \cdots \quad (5)$$

$$W/B \leq 0.34 \quad \cdots \quad (6)$$

where V: protrusion height (mm); W: width (mm) between protrusion bases (W < 5 × V); n: number of protrusions; H: steel-sheet-pile cross-section height (mm); B: steel-sheet-pile web width (mm); t: plate thickness (mm) of steel-sheet-pile-web; and ε_y: yield strain of steel sheet pile.

3. A hat-shaped steel sheet pile which is manufactured by cold working and is used for a permanent structure of a road structure and a harbor structure comprising:

a web;

a pair of flanges;

a pair of arms; and

a pair of joints,

the pair of flanges being formed at both ends of the web, an arm constituting the pair of arms being formed at an end of a flange constituting the pair of flanges, and a joint constituting the pair of joints being provided at a tip of the arm, wherein

the web includes a protrusion over an entire length of the steel sheet pile,

the protrusion is formed by being bent to protrude to an inner surface side or an outer surface side of the web, and

the protrusion satisfies the following expressions (1), (4), (5), and (6)

[Mathematical Expression 3]

$$V \geqq B/16 \quad \cdots\cdots(1)$$

$$2 \leqq \frac{4.1}{\left(\left(\frac{B \times (H/B)^{0.1} \times \sqrt{\varepsilon_y}}{t + \frac{W \times V^{0.85} \times n}{B \times (H/B)^{0.1}}} \right)^2 - 0.25 \right)} \leqq 4 \quad \cdots\cdots(4)$$

$V/H \leq 0.17$ … (5)

$V/B \leq 0.34$ … (6)

where V: protrusion height (mm); W: width (mm) between protrusion bases (W < 5 × V); n: number of protrusions; H: steel-sheet-pile cross-section height (mm); B: steel-sheet-pile web width (mm); t: plate thickness (mm) of steel-sheet-pile-web; and ε_y: yield strain of steel sheet pile.