



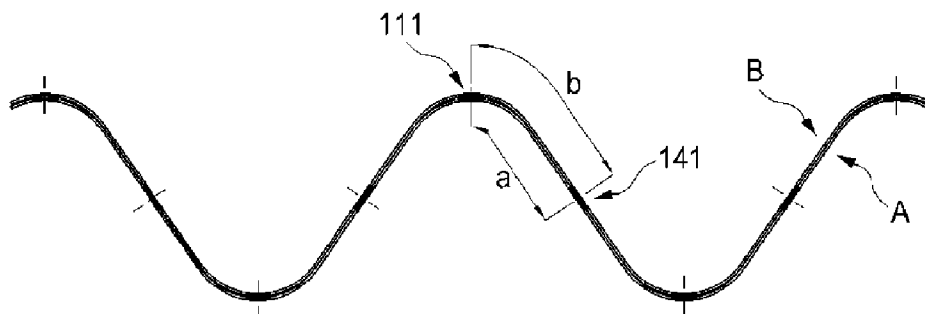
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(72) Inventeurs/Inventors:
RHEE, JONG WHA, KR;
LEE, JUNG HYUN, KR;
KIM, MOON KYUM, KR;
SHIN, JUN HYUM, KR;
LEE, CHOON WOO, KR;
BAEK, KYUNG SOO, KR;
GU, KI HYUN, KR

(73) Propriétaires/Owners:
CHUNGAMENC CO., LTD., KR;

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(54) Title: CORRUGATED STEEL SHEET HAVING INCLINED PORTIONS WITH ADJUSTED COUPLING HOLE POSITIONS



(57) Abrégé/Abstract:

The present invention relates to a corrugated steel sheet, and provides a corrugated steel sheet (B) having an inclined portion in which the position of a coupling hole is adjusted, wherein: among a pair of corrugated steel sheets (A, B), a corrugated steel sheet

(73) Propriétaires(suite)/Owners(continued):DAEDO TECH CO., LTD., KR

(74) Agent: ELAN IP INC.

(57) Abrégé(suite)/Abstract(continued):

(B) is overlapped and joined with the upper portion of a lower corrugated steel sheet (A) and has the same thickness as the lower corrugated steel sheet (A); a common bolt is coupled to both a coupling hole in the lower corrugated steel sheet (A) and a coupling hole in the corrugated steel sheet (B).

【ABSTRACT】

The present invention relates to a corrugated steel sheet, and provides a corrugated steel sheet (B) having an inclined portion in which the position of a coupling hole is adjusted, wherein: among a pair of corrugated steel sheets (A, B), a corrugated steel sheet (B) is overlapped and joined with the upper portion of a lower corrugated steel sheet (A) and has the same thickness as the lower corrugated steel sheet (A); a common bolt is coupled to both a coupling hole in the lower corrugated steel sheet (A) and a coupling hole in the corrugated steel sheet (B).

CORRUGATED STEEL SHEET HAVING INCLINED PORTIONS WITH ADJUSTED COUPLING HOLE POSITIONS

【TECHNICAL FIELD】

The present invention relates to the field of construction, and more particularly to a structure of a corrugated steel sheet.

【BACKGROUND ART】

Because a construction structure using a corrugated steel sheet has a light self-weight, has excellent construction efficiency, and requires a short construction period and low costs as compared with a concrete structure, studies on the application of the construction structure have been actively made.

The conventional corrugated steel sheet includes: a W-shaped body 100 having one central ridge portion 110, two coupling ridge portions 120, two valley portions 130, and four inclined portions 140; coupling holes 111, 121, 131, and 141 formed in the one central ridge portion 110, the two coupling ridge portions 120, the two valley portions 130, and the four inclined portions 140 (FIGS. 1 to 7).

The international standards rule that the corrugated steel sheet in which a depth D of the body 100 is 237 mm, a pitch P of the body 100 is 1000 mm, and a radius R of curvature of the ridge portions 110 and 120 and the valley portions 130 is 80 mm.

A slot structure in which a long diameter of the coupling holes for coupling of the bolts is 32 mm, and a short diameter of the coupling holes is 26 mm, is generally used (FIG. 8).

It is suitable to use bolts having a diameter of 22 mm in the coupling holes (4 mm is a marginal part for a coupling operation).

The thickness d of the corrugated steel sheet is 3 to 12 mm, and FIGS. 1 to 7 illustrate detailed sizes of the corrugated steel sheets having the thicknesses d of 3 mm (FIG. 1), 4 mm (FIG. 2), 5 mm (FIG. 3), 6 mm (FIG. 4), 7.01 mm (FIG. 5), 8 mm (FIG. 6), and 9 mm (FIG. 7).

Meanwhile, the corrugated steel sheet is manufactured to have a predetermined standard (size) in a factory, and it is necessary to assemble the corrugated steel sheet in the field and to form a reinforcing structure according to the design strength of the required structure as well.

FIGS. 9 to 15 illustrate a structure in which two corrugated steel sheets are superimposed on and coupled to each other to form the reinforcing structure.

In this way, when two corrugated steel sheets are superimposed on and coupling to each other, wide through-holes (through-holes formed through alignment of the coupling holes of the two corrugated steel sheets)

are stably formed at portions at which the coupling holes 111 and 121 of the ridge portions and the coupling holes of the valley portions 131 of the two corrugated steel sheets meet each other, and thus there is no problem in commonly coupling the bolts.

However, since a wide through-hole (a through-hole formed through alignment of the coupling holes of the two corrugated steel sheets) is not formed at the portions at which the coupling holes 141 of the inclined portions of the two corrugated steel sheets meet each other, due to the influence of the thicknesses, and the radii of curvature of the ridge portions and the valley portions of the two corrugated steel sheets, it is difficult to commonly couple the bolts.

That is, in the corrugated steel sheet having a thickness d of 3 mm, the diameter of the through-hole is merely 27.68 mm (FIG. 9), in the corrugated steel sheet having a thickness d of 4 mm, the diameter of the through-hole is merely 26.22 mm (FIG. 10), in the corrugated steel sheet having a thickness d of 5 mm, the diameter of the through-hole is merely 24.73 mm (FIG. 11), in the corrugated steel sheet having a thickness d of 6 mm, the diameter of the through-hole is merely 23.25 mm (FIG. 12), in the corrugated steel sheet having a thickness d of 7.01 mm, the diameter of the through-hole is merely 21.73 mm (FIG. 13), in the corrugated steel sheet having a thickness d of 8 mm, the diameter of the through-hole is merely 20.23 mm (FIG. 14), and in the corrugated steel sheet having a thickness d of 9 mm, the diameter of the through-hole is merely 18.66 mm (FIG. 15).

Accordingly, the bolt of the above-mentioned standard (the diameter of 22 mm) cannot be coupled, and when a bolt of a smaller diameter is used, a stable coupling strength cannot be obtained, and when the size of the coupling holes is becomes lager, leakage of water through the marginal space becomes problematic.

The problem becomes more severe as the thickness of the corrugated steel sheets become larger.

【DETAILED DESCRIPTION OF THE INVENTION】

【TECHNICAL PROBLEM】

The present invention has been derived to solve the above-mentioned problems, and provides a corrugated steel sheet having an inclined portion in which the position of a coupling hole is adjusted, which makes to possible to stably superimpose and couple corrugated steel sheets

【TECHNICAL SOLUTION】

In order to solve the above-mentioned problems, in accordance with an aspect of the present invention, there is provided a corrugated steel sheet B having an inclined portion in which a position of a coupling hole is adjusted, which is one of a pair of upper and lower corrugated steel sheets B and A, each of the upper and lower corrugated steel sheets B and A including: a W-shaped body 100 having one central ridge portion 110, two coupling ridge portions 120, two valley portions 130, and four inclined portions 140; and

coupling holes 111, 121, 131, and 141 respectively formed in central sections of the one central ridge portion 110, the two coupling ridge portions 120, the two valley portions 130, and the four inclined portions 140, wherein the corrugated steel sheet B is superimposed on and coupled to the lower corrugated steel sheet A to form a corrugated steel sheet structure, wherein the thickness of the corrugated steel sheet B is the same as a thickness of the lower corrugated steel sheet A, bolts are commonly coupled to the coupling holes of the lower corrugated steel sheet A and the coupling holes of the corrugated steel sheet B, and when assuming that distances between centers of the coupling holes 111 of the central ridge portions and centers of the coupling holes 141 of the inclined portions are coupling hole distances a and b, the coupling hole distance b of the corrugated steel sheet B is calculated in Equation 1:

[Equation 1]

$$b = a + kd - 0.2$$

in which a: the coupling hole distance (mm) of the lower corrugated steel sheet A,

b: the coupling hole distance (mm) of the corrugated sheet sheet B,

k: 1.3 to 1.6, and

d: the thickness of the corrugated steel sheet.

It is preferable that the depth D of the body 100 is 237 mm, the pitch P of the body 100 is 1000 mm, and the radius R of curvature of the ridge

portions 110 and 120 and the valley portions 130 is 80 mm.

It is preferable that the long diameter of the coupling holes is 32 mm, and the short diameter of the coupling holes is 26 mm.

It is preferable that the thickness d of the corrugated steel sheet is 3 to 12 mm.

It is preferable that when the thickness d of the corrugated steel sheet is 3 mm, the coupling hole distance a of the lower corrugated steel sheet A is 181.5 mm and the coupling hole distance b of the corrugated steel sheet B is 185.8 mm, when the thickness d of the corrugated steel sheet is 4 mm, the coupling hole distance a of the lower corrugated steel sheet A is 182.2 mm and the coupling hole distance b of the corrugated steel sheet B is 187.9 mm, when the thickness d of the corrugated steel sheet is 5 mm, the coupling hole distance a of the lower corrugated steel sheet A is 182.6 mm and the coupling hole distance b of the corrugated steel sheet B is 189.9 mm, when the thickness d of the corrugated steel sheet is 6 mm, the coupling hole distance a of the lower corrugated steel sheet A is 183.3 mm and the coupling hole distance b of the corrugated steel sheet B is 192.0 mm, when the thickness d of the corrugated steel sheet is 7.01 mm, the coupling hole distance a of the lower corrugated steel sheet A is 183.9 mm and the coupling hole distance b of the corrugated steel sheet B is 194.2 mm, when the thickness d of the corrugated steel sheet is 8 mm, the coupling hole distance a of the lower corrugated steel sheet A is 184.5 mm and the coupling hole distance b of the corrugated steel sheet B is 196.3 mm, when

the thickness d of the corrugated steel sheet is 9 mm, the coupling hole distance a of the lower corrugated steel sheet A is 184.9 mm and the coupling hole distance b of the corrugated steel sheet B is 198.2 mm, when the thickness d of the corrugated steel sheet is 10 mm, the coupling hole distance a of the lower corrugated steel sheet A is 185.6 mm and the coupling hole distance b of the corrugated steel sheet B is 200.5 mm, when the thickness d of the corrugated steel sheet is 11 mm, the coupling hole distance a of the lower corrugated steel sheet A is 186.2 mm and the coupling hole distance b of the corrugated steel sheet B is 202.6 mm, and when the thickness d of the corrugated steel sheet is 12 mm, the coupling hole distance a of the lower corrugated steel sheet A is 186.8 mm and the coupling hole distance b of the corrugated steel sheet B is 204.8 mm.

In accordance with another aspect of the present invention, there is provided a corrugated steel sheet structure including: the corrugated steel sheet B as herein described; the lower corrugated steel sheet A superimposed on and coupled to a lower portion of the corrugated steel sheet B; and bolts of a diameter of 22 mm commonly coupled to the coupling holes of the lower corrugated steel sheet A and the coupling holes of the corrugated sheet sheet B.

(ADVANTAGEOUS EFFECTS OF THE INVENTION)

The present invention suggests a corrugated steel sheet having an inclined portion in which the position of a coupling hole is adjusted, by which a stable bolt coupling strength can be obtained, waterproof performance can

be improved by minimizing a space between the superimposing and coupling structure of the corrugated steel sheets, and a field construction efficiency can be improved by making a bolt coupling operation easy.

【 DESCRIPTION OF THE DRAWINGS 】

FIGS. 1 to 7 are cross-sectional views of a conventional corrugated steel sheet.

FIG. 8 is a cross-sectional view of a coupling hole.

FIGS. 9 to 15 are cross-sectional views of a coupling structure of the conventional corrugated steel sheet.

FIGS. 16 to 32 illustrates an embodiment of the present invention, in which:

FIGS. 16 to 22 are cross-sectional views of a corrugated steel sheet; and

FIGS. 23 to 32 are cross-sectional views of a coupling structure of the corrugated steel sheet.

*** Description of reference numerals ***

100: body 110: Central ridge portion

111: central hole 120: coupling ridge portion

121: coupling hole 130: valley portion

131: coupling hole 140: inclined portion

141: coupling hole A: lower corrugate steel sheet

a: coupling hole distance of lower corrugated steel sheet B: corrugated steel sheet

b: coupling hole distance of corrugated steel sheet d: thickness of corrugated steel sheet

【 BEST MODE】

Hereinafter, exemplary embodiments of the present disclosure will be described in detail with reference to the accompanying drawings.

As illustrated in the drawings starting from FIG. 1, the present invention relates to a corrugated steel sheet B having an inclined portion in which a position of a coupling hole is adjusted, which is one of a pair of upper and lower corrugated steel sheets B and A, each of the upper and lower corrugated steel sheets B and A including: a W-shaped body 100 having one central ridge portion 110, two coupling ridge portions 120, two valley portions 130, and four inclined portions 140; and coupling holes 111, 121, 131, and 141 formed in central sections of the one central ridge portion 110, the two coupling ridge portions 120, the two valley portions 130, and the four inclined portions 140.

Among the pair of corrugated steel sheets A and B, the corrugated steel sheet B is superimposed on and coupled to the lower corrugated steel sheet A, the thickness of the corrugated steel sheet B is the same as the thickness of the lower corrugated steel sheet A, and bolts are commonly

coupled to the coupling holes of the lower corrugated steel sheet A and the coupling holes of the corrugated steel sheet B.

Here, when assuming that distances between the centers of the coupling holes 111 of the central ridge portions and the centers of the coupling holes 141 of the inclined portions are coupling hole distances a and b , the coupling hole distance b of the corrugated steel sheet B is calculated in Equation 1.

[Equation 1]

$$b = a + kd - 0.2$$

a : the coupling hole distance (mm) of the lower corrugated steel sheet (A)

b : the coupling hole distance (mm) of the corrugated sheet sheet (B)

k : 1.3 to 1.6

d : the thickness of the corrugated steel sheet

That is, there is a problem of not being able to form a wide through-hole (a through-hole formed through alignment of the coupling holes of the two corrugated steel sheets) at a section in which the coupling hole 141 of the inclined portion of the lower corrugated steel sheet A and the coupling hole 141 of the inclined portion of the corrugated steel sheet B meet each other due to the influences of the thicknesses of the two corrugated steel sheets and the radii of curvature of the the ridge portions and the valley

portions, and the problem is solved by changing the locations of the coupling hole 141 of the corrugated steel sheet B.

According to Equation 1, because the position of the coupling hole 141 of the inclined portion of the lower corrugated steel sheet A is determined while taking the distance increased from the coupling hole distance a of the lower corrugated steel sheet A by a product of the thickness d of the corrugated steel sheet and the constant k , as the coupling hole distance b of the corrugated steel sheet B, the widths of the coupling holes formed as the coupling holes 141 of the inclined portions of the two corrugated steel sheets A and B meet each other can be sufficiently ensured, making it possible to couple the bolts 20 (having a diameter of 22 mm) stably.

Because Equation 1 is obtained with the premise of a corrugated steel sheet of the international standards, a stable effect can be expected according to the international standards.

That is, it is preferable that this is applied to the corrugated steel sheet in which the depth D of the body 100 is 237 mm, the pitch P of the body 100 is 1000 mm, and the radius R of curvature of the ridge portions 110 and 120 and the valley portions 130 is 80 mm.

Further, it is preferable that the present invention is applied to the corrugated steel sheet which has coupling holes of a slot structure having a long diameter of 32 mm and a short diameter of 26 mm.

It is suitable to use bolts having a diameter of 22 mm in the coupling holes (4 mm is a marginal part for a coupling operation).

Hereinafter, in order to identify the effects of the present invention, an embodiment to which the present invention is applied for a corrugated steel sheet having a thickness d of 3 to 12 mm will be described.

It could be identified that when the thickness d of the corrugated steel sheet is 3 mm, the coupling hole distance a of the lower corrugated steel sheet A is 181.5 mm, the coupling hole distance b of the corrugated steel sheet B is 185.8 mm, and stable through-holes for bolting are formed as the coupling holes 141 of the inclined portions of the two corrugated steel sheets meet each other (FIGS. 1, 16, and 23).

It could be identified that when the thickness d of the corrugated steel sheet is 4 mm, the coupling hole distance a of the lower corrugated steel sheet A is 182.2 mm, the coupling hole distance b of the corrugated steel sheet B is 187.9 mm, and stable through-holes for bolting are formed as the coupling holes 141 of the inclined portions of the two corrugated steel sheets meet each other (FIGS. 2, 17, and 24).

It could be identified that when the thickness d of the corrugated steel sheet is 5 mm, the coupling hole distance a of the lower corrugated steel sheet A is 182.6 mm, the coupling hole distance b of the corrugated steel sheet B is 189.9 mm, and stable through-holes for bolting are formed as the coupling holes 141 of the inclined portions of the two corrugated steel sheets meet each other (FIGS. 3, 18, and 25).

It could be identified that when the thickness d of the corrugated steel sheet is 6 mm, the coupling hole distance a of the lower corrugated steel sheet A is 183.3 mm, the coupling hole distance b of the corrugated steel sheet B is 192.0 mm, and stable through-holes for bolting are formed as the coupling holes 141 of the inclined portions of the two corrugated steel sheets meet each other (FIGS. 4, 19, and 26).

It could be identified that when the thickness d of the corrugated steel sheet is 7.01 mm, the coupling hole distance a of the lower corrugated steel sheet A is 183.9 mm, the coupling hole distance b of the corrugated steel sheet B is 194.2 mm, and stable through-holes for bolting are formed as the coupling holes 141 of the inclined portions of the two corrugated steel sheets meet each other (FIGS. 5, 20, and 27).

It could be identified that when the thickness d of the corrugated steel sheet is 8 mm, the coupling hole distance a of the lower corrugated steel sheet A is 184.5 mm, the coupling hole distance b of the corrugated steel sheet B is 196.3 mm, and stable through-holes for bolting are formed as the coupling holes 141 of the inclined portions of the two corrugated steel sheets meet each other (FIGS. 6, 21, and 28).

It could be identified that when the thickness d of the corrugated steel sheet is 9 mm, the coupling hole distance a of the lower corrugated steel sheet A is 184.9 mm, the coupling hole distance b of the corrugated steel sheet B is 198.2 mm, and stable through-holes for bolting are formed as the

coupling holes 141 of the inclined portions of the two corrugated steel sheets meet each other (FIGS. 7, 22, and 29).

It could be identified that when the thickness d of the corrugated steel sheet is 10 mm, the coupling hole distance a of the lower corrugated steel sheet A is 185.6 mm, the coupling hole distance b of the corrugated steel sheet B is 200.5 mm, and stable through-holes for bolting are formed as the coupling holes 141 of the inclined portions of the two corrugated steel sheets meet each other (FIG. 30).

It could be identified that when the thickness d of the corrugated steel sheet is 11 mm, the coupling hole distance a of the lower corrugated steel sheet A is 186.2 mm, the coupling hole distance b of the corrugated steel sheet B is 202.6 mm, and stable through-holes for bolting are formed as the coupling holes 141 of the inclined portions of the two corrugated steel sheets meet each other (FIG. 31).

It could be identified that when the thickness d of the corrugated steel sheet is 12 mm, the coupling hole distance a of the lower corrugated steel sheet A is 186.8 mm, the coupling hole distance b of the corrugated steel sheet B is 204.8 mm, and stable through-holes for bolting are formed as the coupling holes 141 of the inclined portions of the two corrugated steel sheets meet each other (FIG. 32).

Since the above description is merely a description of some of the preferred embodiments which may be realized by the present invention, the scope of the present invention should not be construed to be limited to the

above embodiment as known and the technical spirit of the present invention, which has been described above, and the technical spirit having the common basic concept as that of the present invention will fall within the scope of the present invention.

CLAIMS:

1. Corrugated steel sheet having inclined portions with adjusted coupling hole portions, which is one of a pair of upper and lower corrugated steel sheets , each of the upper and lower corrugated steel sheets including:

a W-shaped body having one central ridge portion , two coupling ridge portions , two valley portions , and four inclined portions ; and

coupling holes respectively formed in central sections of the one central ridge portion , the two coupling ridge portions , the two valley portions , and the four inclined portions ,

wherein the corrugated steel sheet is superimposed on and coupled to the lower corrugated steel sheet to form a corrugated steel sheet structure,

wherein the thickness of the corrugated steel sheet is the same as a thickness of the lower corrugated steel sheet ,

bolts are commonly coupled to the coupling holes of the lower corrugated steel sheet and the coupling holes of the corrugated steel sheet , and

when assuming that distances between centers of the coupling holes of the central ridge portions and centers of the coupling holes of the inclined portions are coupling hole distances (a, b), the coupling hole distance (b) of the corrugated steel sheet is calculated in Equation 1:

[Equation 1]

$$b = a + kd - 0.2$$

in which a: the coupling hole distance (mm) of the lower corrugated steel sheet , b: the coupling

hole distance (mm) of the corrugated sheet sheet , k: 1.3 to 1.6, and d: the thickness of the corrugated steel sheet (mm),

wherein a depth of the body is 237 mm, a pitch of the body is 1000 mm, and a radius of curvature of the ridge portions and the valley portions is 80 mm, and

wherein a long diameter of the coupling holes is 32 mm, and a short diameter of the coupling holes is 26 mm.

2. The corrugated steel sheet of claim 1, wherein the thickness (d) of the corrugated steel sheet is 3 to 12 mm.

3. The corrugated steel sheet of claim 1, wherein when the thickness (d) of the corrugated steel sheet is 3 mm, the coupling hole distance (a) of the lower corrugated steel sheet is 181.5 mm and the coupling hole distance (b) of the corrugated steel sheet is 185.8 mm,

when the thickness (d) of the corrugated steel sheet is 4 mm, the coupling hole distance (a) of the lower corrugated steel sheet is 182.2 mm and the coupling hole distance (b) of the corrugated steel sheet is 187.9 mm,

when the thickness (d) of the corrugated steel sheet is 5 mm, the coupling hole distance (a) of the lower corrugated steel sheet is 182.6 mm and the coupling hole distance (b) of the corrugated steel sheet is 189.9 mm,

when the thickness (d) of the corrugated steel sheet is 6 mm, the coupling hole distance

(a) of the lower corrugated steel sheet is 183.3 mm and the coupling hole distance (b) of the corrugated steel sheet is 192.0 mm,

when the thickness (d) of the corrugated steel sheet is 7.01 mm, the coupling hole distance (a) of the lower corrugated steel sheet is 183.9 mm and the coupling hole distance (b) of the corrugated steel sheet is 194.2 mm,

when the thickness (d) of the corrugated steel sheet is 8 mm, the coupling hole distance (a) of the lower corrugated steel sheet is 184.5 mm and the coupling hole distance (b) of the corrugated steel sheet is 196.3 mm,

when the thickness (d) of the corrugated steel sheet is 9 mm, the coupling hole distance (a) of the lower corrugated steel sheet is 184.9 mm and the coupling hole distance (b) of the corrugated steel sheet is 198.2 mm,

when the thickness (d) of the corrugated steel sheet is 10 mm, the coupling hole distance (a) of the lower corrugated steel sheet is 185.6 mm and the coupling hole distance (b) of the corrugated steel sheet is 200.5 mm,

when the thickness (d) of the corrugated steel sheet is 11 mm, the coupling hole distance (a) of the lower corrugated steel sheet is 186.2 mm and the coupling hole distance (b) of the corrugated steel sheet is 202.6 mm, and

when the thickness (d) of the corrugated steel sheet is 12 mm, the coupling hole distance (a) of the lower corrugated steel sheet is 186.8 mm and the coupling hole distance (b) of the corrugated steel sheet is 204.8 mm.

4. A corrugated steel sheet structure comprising:

the corrugated steel sheet claimed in claim 1 to 3;

the lower corrugated steel sheet superimposed on and coupled to a lower portion of the corrugated steel sheet ; and

bolts of a diameter of 22 mm commonly coupled to the coupling holes of the lower corrugated steel sheet and the coupling holes of the corrugated steel sheet .

FIG. 1 [PRIOR ART]



Figure 1 is a technical drawing of a cross-section of a corrugated metal structure. The structure consists of a series of repeating wave-like segments. Key dimensions and labels include: a total width of 1078; a central segment width of 500; side segments of 39; a height of 237; a wave angle of 55.50°; a radius of curvature $R=80$; a distance of 1000 between the centers of the waves; and a distance of 250 from the center of a wave to the side edge. The structure is labeled with 110, 111, 120, 121, 140, 141, and 130.

Technical drawing of a corrugated metal profile. The profile is shown in a side view, illustrating its wavy shape. Key dimensions and labels include:

- Overall Width:** 1078
- Wave Period (Pitch):** 500
- Wave Height:** 110
- Wave Angle:** 55.60°
- Radius of Curvature:** $R=80$
- Flange Width:** 39
- Flange Thickness:** 121
- Flange Height:** 120
- Wave Height (Internal):** 141
- Wave Height (External):** 140
- Wave Length (Internal):** 199.64
- Wave Length (External):** 199.64
- Wave Length (Internal):** 183.3
- Wave Length (External):** 183.3
- Wave Length (Internal):** 250
- Wave Length (External):** 250
- Wave Length (Internal):** 1000
- Wave Length (External):** 1000
- Wave Length (Internal):** 130
- Wave Length (External):** 130
- Wave Length (Internal):** 237
- Wave Length (External):** 237

FIG. 5 [PRIOR ART]

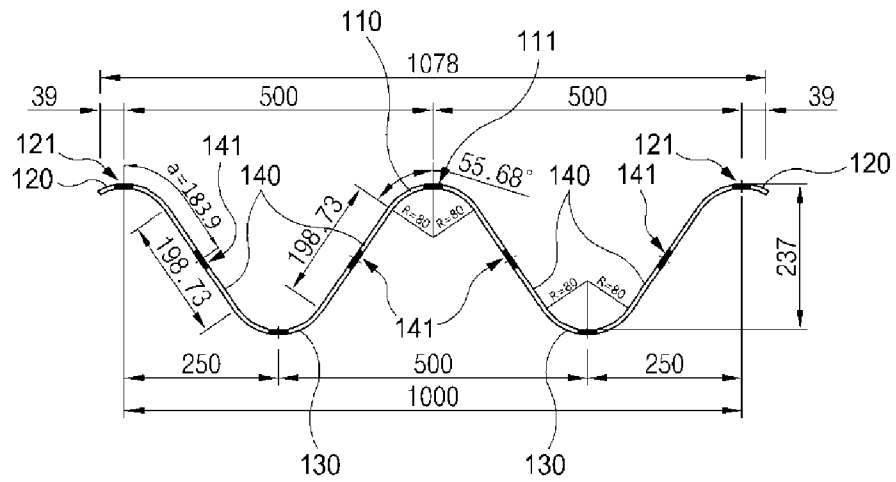


FIG. 6 [PRIOR ART]

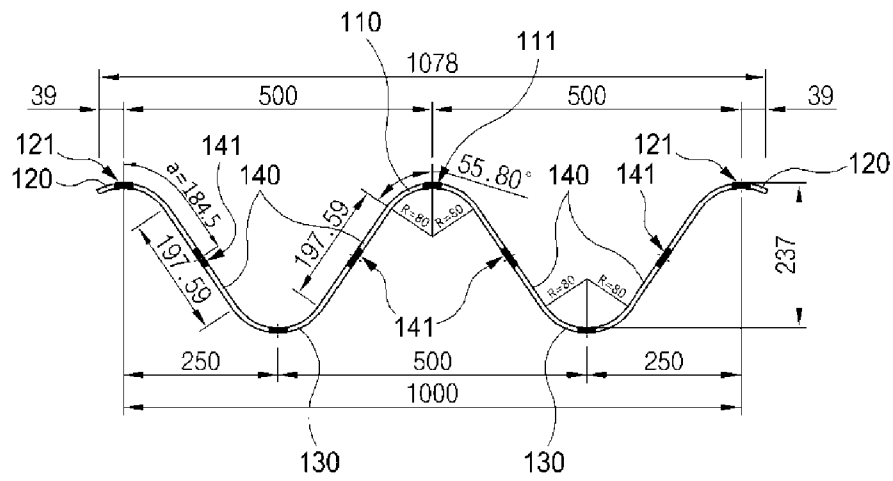


FIG. 7 [PRIOR ART]

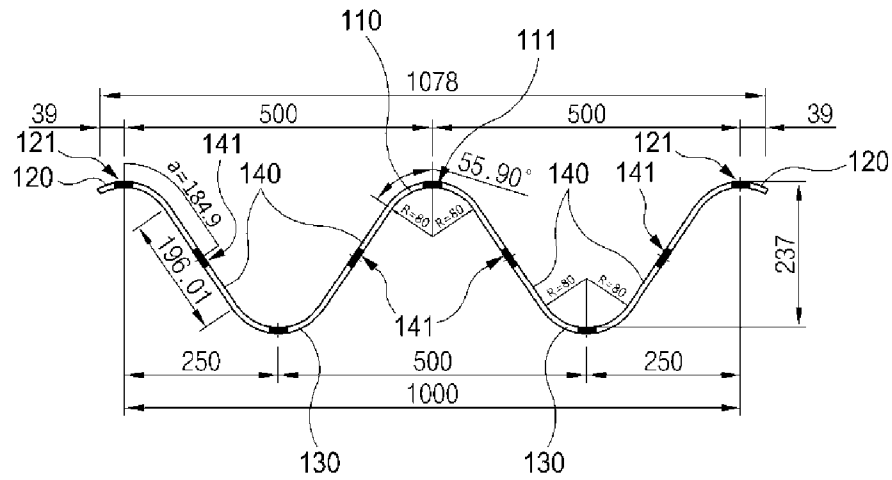


FIG. 8 [PRIOR ART]

111,121,131,141

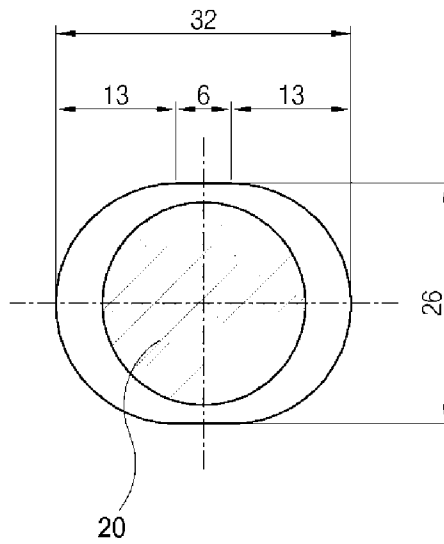


FIG. 9 [PRIOR ART]

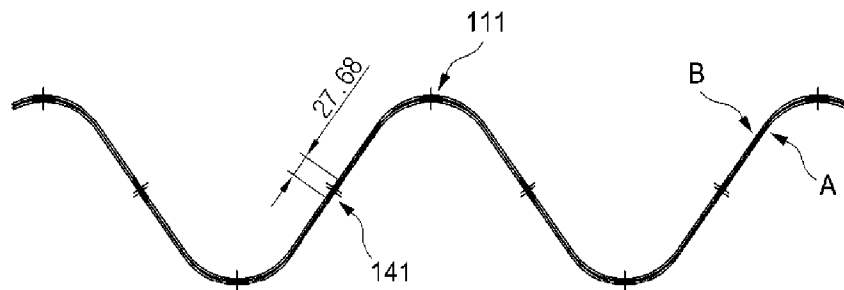


FIG. 10 [PRIOR ART]

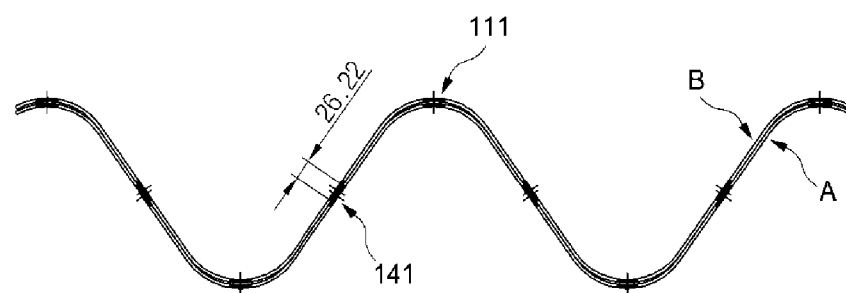


FIG. 11 [PRIOR ART]

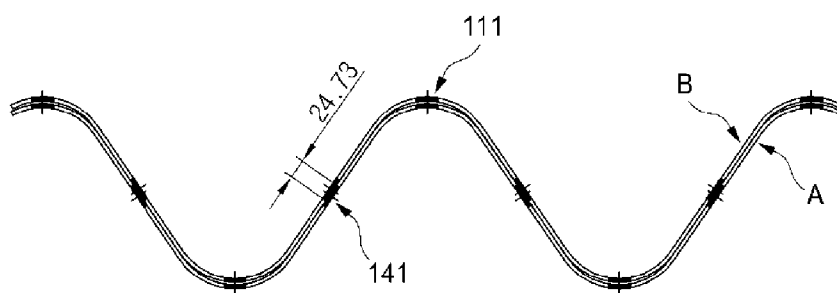


FIG. 12 [PRIOR ART]

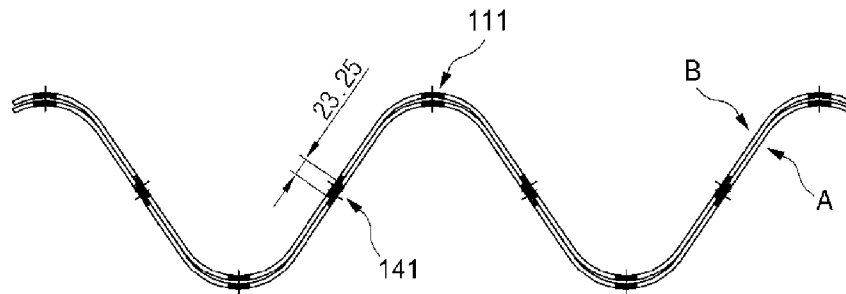


FIG. 13 [PRIOR ART]

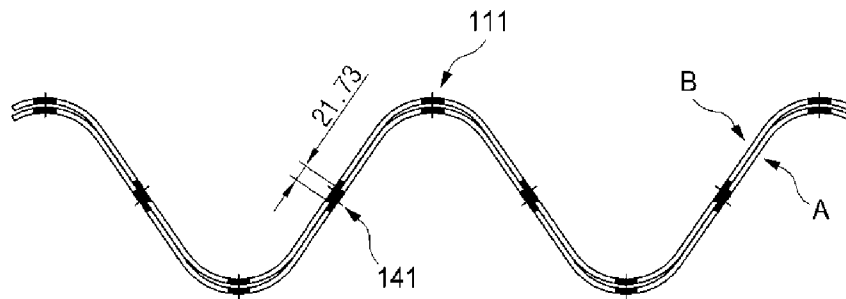


FIG. 14 [PRIOR ART]

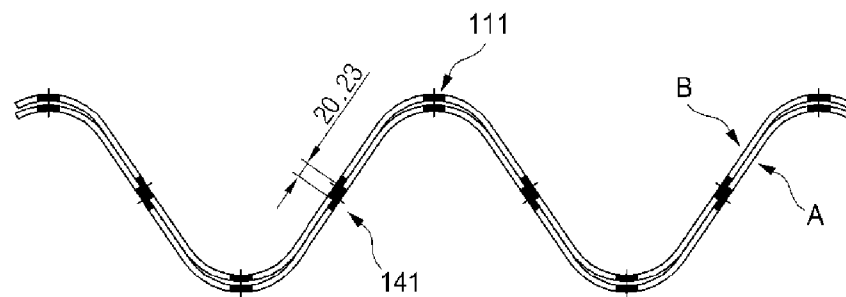


FIG. 15 [PRIOR ART]

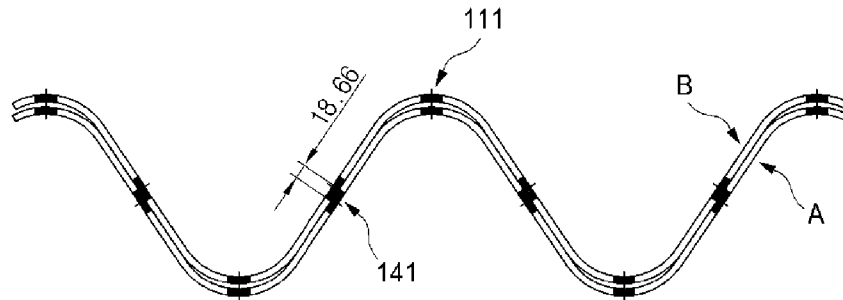


FIG. 16

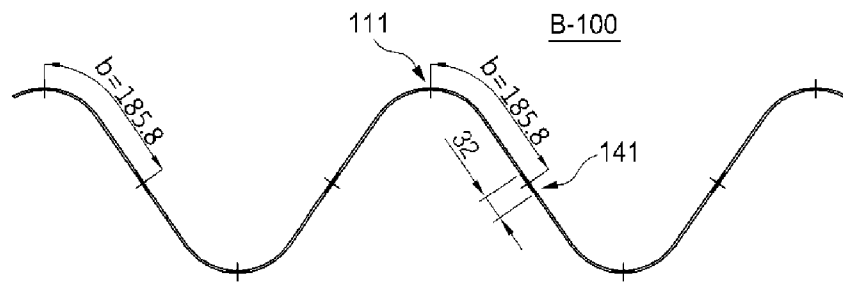


FIG. 17

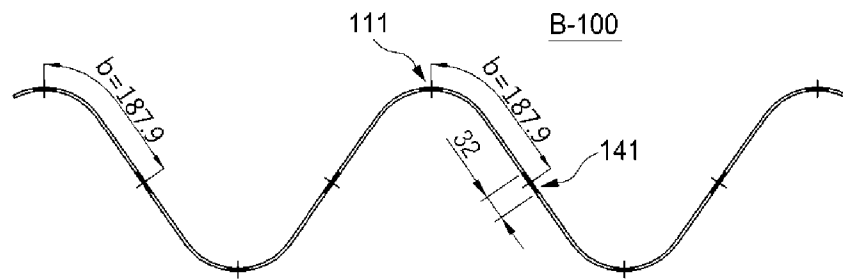


FIG. 18

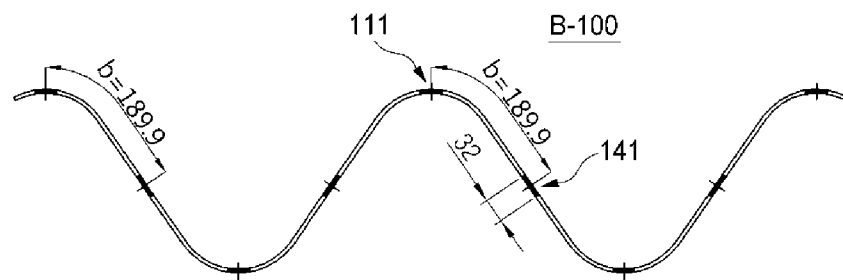


FIG. 19

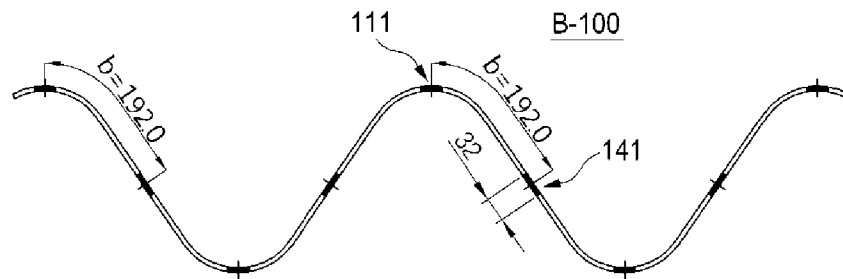


FIG. 20

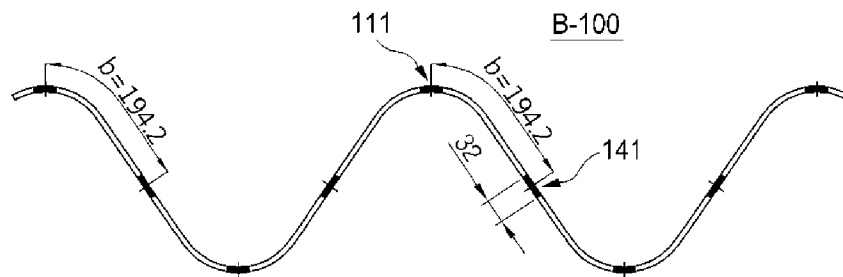


FIG. 21

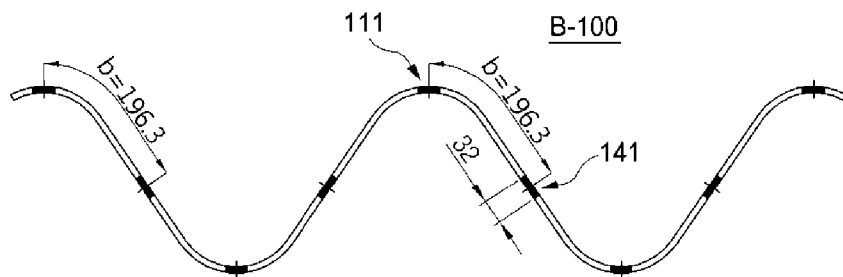


FIG. 22

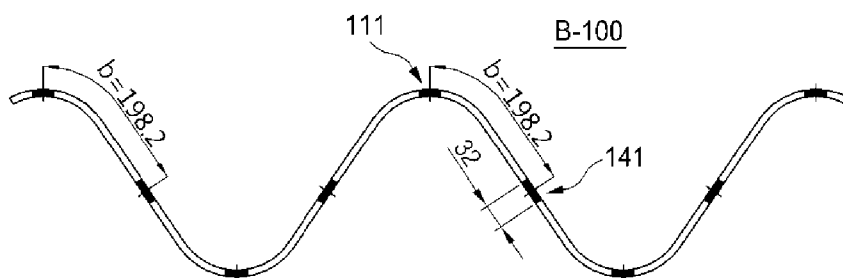


FIG. 23

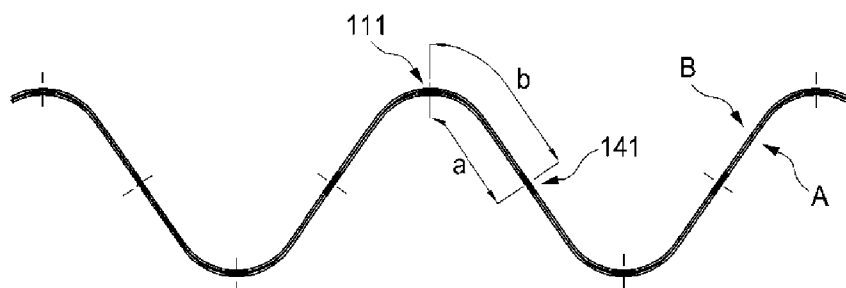


FIG. 24

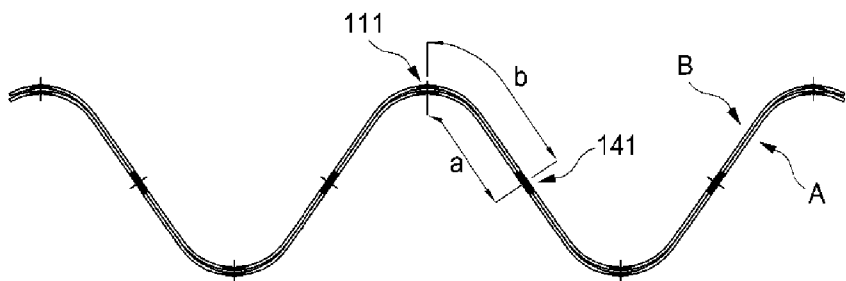


FIG. 25

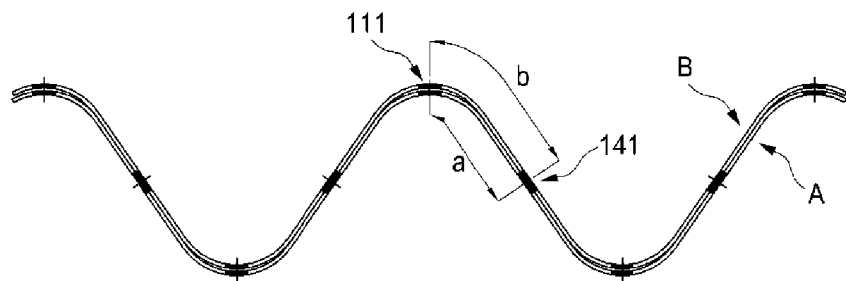


FIG. 26

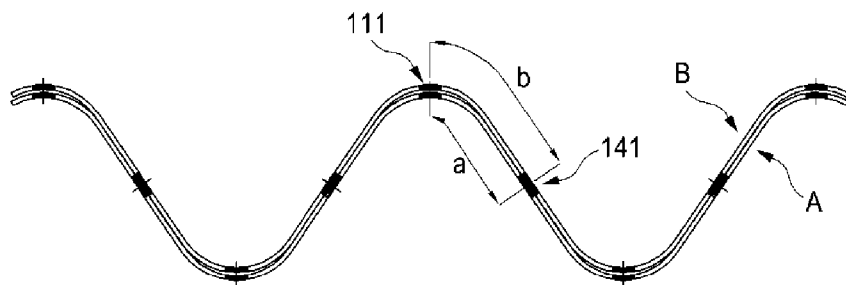


FIG. 27

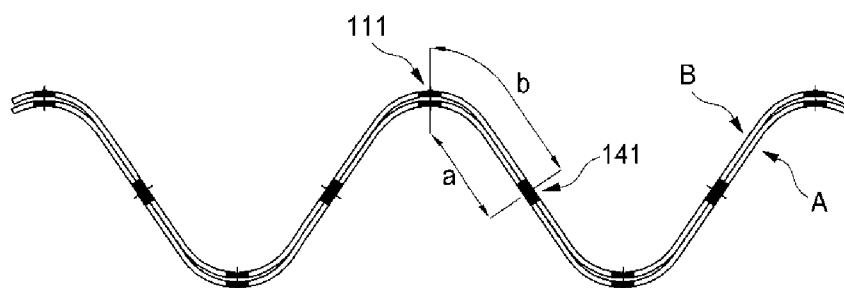


FIG. 28

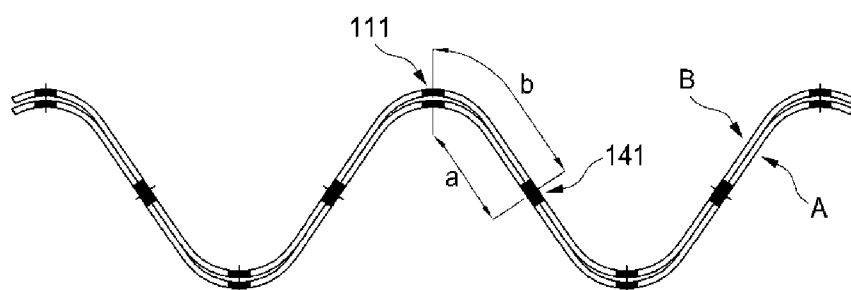


FIG. 29

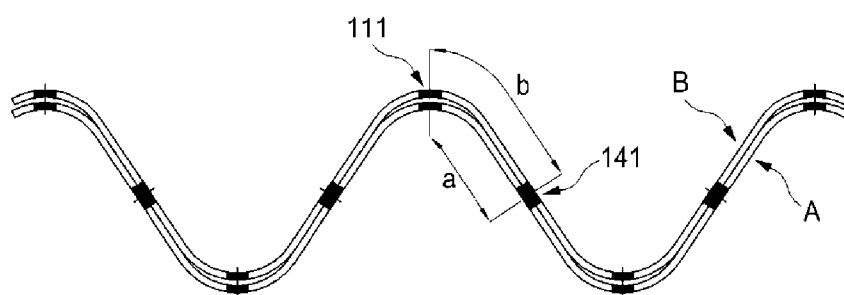


FIG. 30

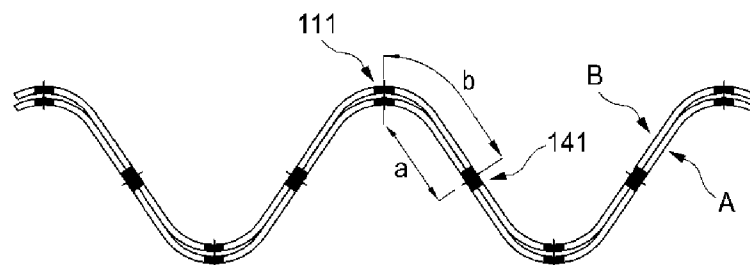


FIG. 31

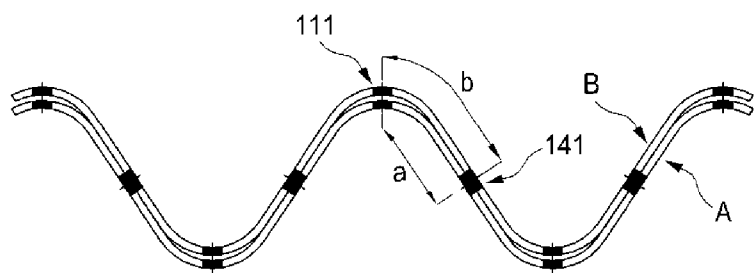


FIG. 32

