A shape for sheet metal stampings is provided that will minimize the radiation of sound from the panel, thereby reduce or eliminate the need to add supplemental acoustical absorbing or barrier materials. The sheet metal panel shape includes a crown portion, a peripheral flange that extends around the boundary of the crown portion, a flat portion that truncates the crown, and a bead pattern that is formed in at least the flat portion of the panel, whereby the crown and the flat and the bead pattern cooperate to define a panel shape that has low sound radiation. The bead pattern can also extend part way or more into the crown portion.
SHEET METAL PANEL SHAPE FOR LOW SOUND RADIATION

FIELD OF THE INVENTION

[0001] The present invention relates to the shaping of a sheet metal panel to minimize noise emission and more particularly provides a sheet metal panel having a combination of a flange, a crown, a flat and a bead to reduce sound radiation while it is exposed to vibration.

BACKGROUND OF THE INVENTION

[0002] It is well known to construct a motor vehicle body by welding together a number of sheet metal panels. When the vehicle is driven, these sheet metal panels are subjected to vibrational energy from the engine and from the highway surface. This vibrational energy is transmitted into sound radiations as the panels vibrate. The vibration of panels in this way is especially critical in the large flat panels used in the vehicle floor, including the luggage compartment and in the foot wells. Because the radiated sound is objectionable, it is well known to install acoustic materials that will dampen the vibration and thereby reduce the emission of sound from the body panels.

[0003] It would be desirable to provide new and improved sheet metal panel shapes that would reduce or eliminate the transmission of sound and minimize the need for the installation of acoustic dampening materials.

SUMMARY OF THE INVENTION

[0004] A shape for sheet metal stampings is provided that will minimize the radiation of sound from the panel, to thereby reduce or eliminate the need to add supplemental acoustical absorbing or barrier materials. The sheet metal panel shape includes a crown portion, a peripheral flange that extends around the boundary of the crown portion, a flat portion that truncates the crown, and a bead pattern that is formed in at least the flat portion of the panel, whereby the crown and the flat and the bead pattern cooperate to define a panel shape that has low sound radiation. The bead pattern can also extend part way or more into the crown portion.

[0005] It should be understood that the detailed description and specific exemplary embodiments of the invention, are intended for purposes of illustration only and are not intended to limit the scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] The present invention will become more fully understood from the detailed description and the accompanying drawings wherein:

[0007] FIG. 1 is a perspective view of a sheet metal panel according to the invention.
[0008] FIG. 1A is a section view taken in the direction of arrows 1A-1A of FIG. 1.
[0009] FIG. 1B is a section taken in the direction of arrows 1B-1B in FIG. 1.
[0010] FIG. 2 is a perspective view of a panel similar to that of FIG. 1 but having the beads thereof stamped in the opposite direction.
[0011] FIG. 2A is a section view taken in the direction of arrows 2A-2A of FIG. 2.
[0012] FIG. 2B is a section view taken in the direction of arrows 2B-2B of FIG. 2.

[0013] FIG. 3 is a perspective view of another embodiment of the sheet metal panel according to the invention.
[0014] FIG. 3A is a section view taken in the direction of arrows 3A-3A of FIG. 3.
[0015] FIG. 3B is a section taken in the direction of arrows 3B-3B of FIG. 3.
[0016] FIG. 4 is a perspective view of another embodiment of the sheet metal panel according to the invention.
[0017] FIG. 4A is a section view taken in the direction of arrows 4A-4A of FIG. 4.
[0018] FIG. 4B is a section taken in the direction of arrows 4B-4B of FIG. 4.
[0019] FIG. 5 is a perspective view of another embodiment of the sheet metal panel according to the invention.
[0020] FIG. 5A is a section view taken in the direction of arrows 5A-5A of FIG. 5.
[0021] FIG. 5B is a section taken in the direction of arrows 5B-5B of FIG. 5.
[0022] FIG. 6 is a perspective view of another embodiment of the sheet metal panel according to the invention.
[0023] FIG. 6A is a section view taken in the direction of arrows 6A-6A of FIG. 6.
[0024] FIG. 6B is a section taken in the direction of arrows 6B-6B of FIG. 4.
[0025] FIG. 7 is a perspective view of another embodiment of the sheet metal panel according to the invention.
[0026] FIG. 7A is a section view taken in the direction of arrows 7A-7A of FIG. 7.
[0027] FIG. 7B is a section taken in the direction of arrows 7B-7B of FIG. 7.
[0028] FIG. 8 is a perspective view of a vehicle floor pan embodying the invention.

DETAILED DESCRIPTION OF THE EXEMPLARY EMBODIMENTS

[0029] Referring to FIGS. 1, 1A, and 1B, it is seen that a sheet metal panel 10 is provided and includes a peripheral flange 12, a crown 14, a flat 16 and a bead pattern 18. The flange 12 defines the outer edge of the panel 10 and generally bounds the four sides of the panel 14. Panel 10 is shown to be generally rectangular in shape and thus the flange 12 can be seen to include end flanges 12A and 12B and side flanges 12C and 12D. The flange 12 enables the panel 10 to be welded to adjacent panels, or the panel 10 can be integral with the adjacent panels and stamped in one piece therewith. As seen in FIGS. 1A and 1B, the flange 12 is preferably in a single plane. Sheet metal panel 10 is made in a sheet metal stamping process in which the panel 10 is shaped between an upper die and a lower die which from the shape of the panel 10 including the flange 12, crown 14, flat 16 and the bead pattern 18.

[0030] As best seen in FIGS. 1A and 1B, the crown 14 is a curvilinear or bulb shaped 12 that extends from and between the end flanges 12A and 12B and the side flanges 12C and 12D so that the panel 10 assumes a dish shape. The crown 14 slopes from the flange 12 and is truncated by the flat 16 that is a flat surface generally parallel with the flange 12.

[0031] As seen in the drawings the bead pattern 18 of FIG. 1 is a ladder shape and includes a central or center spine 24 and a plurality of rungs 26, 28 and 30 that extend laterally from each side of the center spine 24. As seen in FIG. 1A, the center spine 24 has a length such that it extends along the flat 16 of the panel 10 and does not reach into the crown 14. As seen in FIG. 1B, the rung 28, which is typical of the rungs 26,
28 and 30, has a length such that each of the rungs extends across the flat 16 and down the crown 14 to merge with the flange 12.

[0032] FIGS. 2, 2A, and 2B show another embodiment of the invention which is a panel 210 similar to that of FIG. 1, provided however that the bead pattern 218 is stamped in the opposite direction so that the overall height “H2” of the panel 210 in FIGS. 2A and 2B is less than the overall height “H1” of the panel 10, in FIGS. 1A and 1B. In particular, in FIG. 2 the panel 210 has a flange 212, a crown 214, a flat 216, and bead pattern 218. The bead pattern 218 includes a spine 224 and rungs 226, 228 and 230. The flat 212 includes end flanges 212A and 212B and side flanges 212C and 212D. As seen in FIGS. 2A and 2B the bead pattern 218 is recessed into the shape of the panel 210 rather than projecting further beyond the crown shape as had been the case in the panel 10 of FIG. 1. In this way, it is seen that the overall height H2 of the FIG. 2 panel is less than the overall height H1 of the FIG. 1 panel. The lesser overall height of the panel in the example of FIG. 2 may be advantageous in some motor vehicle applications where it is desirable to minimize the overall height of the panel and yet obtain the desired goal of reducing the radiation of sound from the panel.

[0033] FIGS. 3, 3A and 3B show another embodiment of the invention. Panel 310 includes flange 312, crown 314, flat 316 and bead pattern 318. The crown 314 is a curvilinear or bulged shape that extends from and between end flanges 312A and 312B and side flanges 312C and 312D so that the panel 310 assumes a dish shape. The crown 314 slopes from the flange 312 and is truncated by the flat 316 that is a flat surface generally parallel with the flange 312. The bead pattern 318 includes a center spine 324 and a plurality of rungs 326, 328, 330, 332, 334, and 336. As seen in FIG. 3A, the center spine 324 has a length such that it extends along the flat 316 of the panel 310 and also reaches across the crown 314 to merge with the end flanges 312A and 312B. Thus, the spine 324 is coextensive with the both the crown 314 and the flat 316. As seen in FIG. 3B, the rung 328 which is typical, has a length such that each of the rungs extends across the flat 316 and down the crown 314 to merge with the side flanges 312C and 312D. Thus, the rungs are coextensive with both the crown and the flat. Overall then, the bead pattern 318 extends through both the crown 314 and the flat 316 and merges with the flange 312.

[0034] FIGS. 4, 4A and 4B show another embodiment of the invention. Panel 410 includes flange 412, crown 414, flat 416 and bead pattern 418. The crown 414 extends from the flange 412. As seen in FIG. 4A, the center spine 424 has a length such that it extends along the flat 416 of the panel 410 and also reaches part way into the crown 414 but stops short of the end flanges 412A and 412B. Thus, the spine is coextensive with the entire flat 416 and also extend part way but not all the way into the crown 414. As seen in FIG. 4B, the rungs 426, 428, 430, and 432 have a length such that each of the rungs extends across the flat 416 but do not extend into the crown 414. Thus the rungs are coextensive with only the flat 416. Overall then, the bead pattern 418 of the embodiment of FIG. 4 has a spine 424 that extends all the way through the flat and part way into the crown and rungs that extend only within the flat.

[0035] FIGS. 5, 5A and 5B show another embodiment of the invention. Panel 510 includes flange 512, crown 514, flat 516 and bead pattern 518. The crown 514 extends continuously from the flange 512. The bead pattern 518 is a pair of discrete spaced apart rungs or depressions 526 and 528 and there is no spine. The rungs 526 and 528 extend toward side flanges 512C and 512D, but as shown in FIG. 4, reside entirely in the flat 516 and do not extend into the crown 514.

[0036] FIGS. 6, 6A and 6B show another embodiment of the invention. Panel 610 includes flange 612, crown 614, flat 616 and bead pattern 618. The crown 614 extends continuously from the flange 612. The bead pattern 618 is a single rectangular shaped rung or depression or spine 626. As seen in FIG. 6A, the rung 626 extends only part way across the flat 616 and does not reach the crown 614, while in the other direction as seen in FIG. 6B, the rung extends fully across the flat 616 and merges with the crown 614. Thus, whether called a spine or a rung, it is seen that this bead pattern 618 is coextensive with the flat in one direction and shorter than the flat in the other direction.

[0037] FIGS. 7, 7A and 7B show another embodiment of the invention. Panel 710 includes flange 712, crown 714, flat 716 and bead pattern 718. The crown 714 extends continuously from the flange 712. The bead pattern 718 is a single rectangular shaped rung or depression or spine 724. As seen in FIG. 7A and 7B, the rung 724 extends only part way across the flat 716 and does not fully reach the crown 714 in either direction. Thus, whether called a spine or a rung, it is seen that the rung 724 can be located completely and only within the flat 716 and not reach the crown 714.

[0038] Referring now to FIG. 8, it is seen that the invention herein can be readily incorporated in vehicle body panels. For example, FIG. 8 shows a vehicle floor pan panel 802 that is stamped as one large panel but has separate regions including a rear seat pan 804, a shelf 806 behind the rear seat, and a spare tire or luggage shelf 808 that will be located within the luggage compartment. It is seen that the shelf 806 has a peripheral flange portion 812 including end flanges 812A and 812B as well as side flanges 812C and 812D. The shelf 806 has a crown 814 that is truncated by a flat 816. A bead pattern, generally indicated at 850, is provided in the shelf 806. It will be understood that the relationship between the flange, the crown and the flat, as well as the shape of the bead pattern for the shelf 806 can be according to any of the embodiments of FIG. 1-7.

[0039] The shelf 808 is similar to the shelf 806 and includes the elements of a peripheral flange 862, a crown 864, a flat 866, and bead pattern 868. It will be understood that for this shelf 808 the relationship between the flange, the crown and the flat, as well as the shape of the bead pattern can be according to any of the embodiments of FIG. 1-7. In addition it will be understood that the bead pattern can be either depressed downwardly into the panel as in the example of FIG. 1, or raised upwardly from the panel as in the example of FIG. 2.

[0040] In view of the foregoing, it will be understood that the invention provides a new and improved shape for sheet metal stampings that will minimize the radiation of sound radiation from the panel, thereby minimizing the need to add supplemental acoustical materials.

[0041] The description of the invention is merely exemplary in nature and, thus, variations thereof are intended to be within the scope of the invention.

What is claimed is:
1. A sheet metal panel comprising:
a crown portion;
a peripheral flange that extends around the boundary of the crown portion;
a flat portion that truncates the crown;
and a bead pattern formed in at least the flat portion of the panel;
whereby the crown, and the flat, and the bead pattern, cooperate to define a panel shape that has low sound radiation.

2. The sheet metal panel of claim 1 further comprising the bead pattern rising from the flat portion in a direction that adds to the height of the crown.

3. The sheet metal panel of claim 1 further comprising the bead pattern rising from the flat portion in a direction opposite to the direction that would add to the height of the crown so that overall height of the panel is not increased by the presence of the bead pattern.

4. The sheet metal panel of claim 1 further comprising the bead pattern being a ladder shape with a central spine and a plurality of lateral rungs that extend transverse to the spine.

5. The sheet metal panel of claim 4 further comprising the spine residing in the flat portion and not the crown.

6. The sheet metal panel of claim 4 further comprising the spine extending across the entire flat portion and at least part way into the crown.

7. The sheet metal panel of claim 4 further comprising the lateral rungs residing in only the flat portion and not the crown.

8. The sheet metal panel of claim 4 further comprising the lateral rungs extending across the entire flat portion and at least part way into the crown.

9. The sheet metal panel of claim 4 further comprising the spine extending across the entire flat portion and the entire crown portion to the peripheral flange.

10. The sheet metal panel of claim 4 further comprising the lateral rungs extending across the entire flat portion and the entire crown portion to the peripheral flange.

11. The sheet metal panel of claim 1 further comprising the bead pattern being at least one or more rectangular shaped depressions that are provided in at least the flat portion.

12. The sheet metal panel of claim 1 further comprising the bead pattern being at least one or more rectangular shaped depressions that are provided in at least the flat portion and extend at least part way into the crown.

13. The sheet metal panel of claim 1 further comprising the bead pattern being a plurality of rectangular shaped depressions that are provided in at least the flat portion.

14. The sheet metal panel of claim 1 further comprising the bead pattern being a plurality of rectangular shaped depressions that are provided in at least the flat portion and extend at least part way into the crown.

15. A sheet metal panel comprising:
a crown portion that is bounded by a peripheral flange;
a flat portion that truncates the crown;
and a ladder shaped bead pattern that rises from the flat portion of the panel and extends at least part way into the crown.

16. The sheet metal panel of claim 15 further comprising the bead pattern being a ladder shape with a central spine and a plurality of lateral rungs that extend transverse to the spine.

17. The sheet metal panel of claim 16 further comprising the bead pattern rising from the flat portion in a direction that adds to the height of the crown.

18. The sheet metal panel of claim 16 further comprising the bead pattern rising from the flat portion in a direction opposite to the direction that would add to the height of the crown so that overall height of the panel is not increased by the presence of the bead pattern.

19. A sheet metal panel comprising:
a crown portion that is bounded by a peripheral flange;
a flat portion that truncates the crown;
and a ladder shaped bead pattern having a central spine and a plurality of lateral rungs that rise from the flat portion of the panel and extend at least part way into the crown.

20. The sheet metal panel of claim 19 further comprising the bead pattern rising from the flat portion in a direction that either adds to the height of the crown or rise in a direction opposite to the direction that would add to the height of the crown so that overall height of the panel is not increased by the presence of the bead pattern.

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