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(71) Applicant(s)
Pandrol Limited

(72) Inventor(s)
Hamilton, Robert John;Cox, Stephen John

(74) Agent / Attorney
**Watermark Patent and Trade Marks Attorneys, Level 2 302 Burwood Road,
HAWTHORN, VIC, 3122**

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(74) Agent: **FENLON, Christine, Lesley**; HASELTINE
LAKE, Lincoln House, 300 High Holborn, London WC1V
7JH (GB).

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(71) Applicant (*for all designated States except US*): **PAN-
DROL LIMITED** [GB/GB]; 63 Station Road, Addlestone,
Surrey KT15 2AR (GB).

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(72) Inventors; and

(75) Inventors/Applicants (*for US only*): **COX, Stephen,
John** [GB/GB]; 5 Selwyn Avenue, Richmond, Surrey
TW9 2HB (GB). **HAMILTON, Robert, John** [GB/GB];
17 Alterton Close, Goldsworth Park, Woking, Surrey
GU21 3DD (GB).

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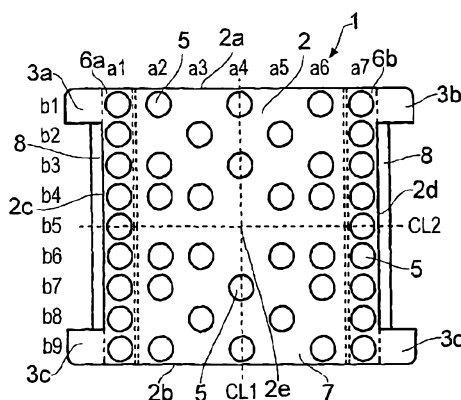


FIG. 1A

(57) Abstract: In a railway rail pad (1) having a rail seat portion (2) for receiving a foot of a railway rail, the rail seat portion (2) is provided on at least one major face (4A, 4B) thereof with a plurality of protrusions (5) which are unevenly distributed across the face of the rail seat portion (2) such that the ratio of the area of the face occupied by the protrusions (5) to the area of the face free of protrusions (5) is greater in an edge region (6a, 6b) of the rail seat portion (2) than in a central region (7) of the rail seat portion (2), the edge region (6a, 6b) being adjacent to one edge of the pad (1) and the central region (7) being adjacent to the edge region (6a, 6b). The studs (5) are arranged in columns (a1 to a7), each stud (5) being of substantially the same size, and the number of studs (5) in a column in the central region (7) which is closest to said edge region (6a, 6b) being greater than in a column closer to the centre of the rail seat portion (2). The studs (5) are also arranged in rows (b1 to b9), wherein the ratio of protrusions to free area in a row of studs (5) adjacent to, but spaced from, the centre of the rail seat portion (2) is greater than that in a row further from the centre.

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RAILWAY RAIL PAD**FIELD OF THE INVENTION**

The present invention relates to a railway rail pad.

BACKGROUND TO THE INVENTION

5 Railway rail pads are provided between a foot of a railway rail and an underlying rail foundation, the pad having a rail seat portion for receiving the rail foot. Rail pads are typically made of resilient elastomeric material such as ethylene vinyl acetate (EVA). In a typical rail pad the rail seat portion is provided with a plurality of protrusions, such as studs or ribs, on one or both major faces.

10 The design of the pad and the material used to make it are chosen so as to ensure that the pad has desired stiffness and wear characteristics, according to the requirements of the railway track in which it is to be used.

SUMMARY OF THE INVENTION

15 An aspect of the present invention provides railway rail pad for location between a foot of a railway rail and an underlying rail foundation, the pad including:

20 a rail seat portion for receiving a foot of a railway rail, the rail seat portion including two opposite edges which extend parallel to a longitudinal axis of the rail when the pad is in use, the rail seat portion is provided with a plurality of studs on at least one major face thereof, wherein at least some of the studs are located along the centre line parallel to the longitudinal axis of the rail or wherein substantially no studs are located in the inner region of the centre line which lies perpendicular to the longitudinal axis of the rail, wherein the studs are unevenly distributed across the face of the rail seat portion such that a ratio of the area of
25 the face occupied by the studs to the area of the face free of the studs is greater in an edge region of the rail seat portion than in a central region of the rail seat portion with the edge region being adjacent to one of the edges wherein the central region is adjacent to the edge region;

wherein the studs are arranged in columns, extending substantially parallel to the opposite edges, each stud being of substantially the same size, and the number of studs in a column in the central region which is closest to the edge region being greater than in a column closer to the centre of the rail seat portion, and

wherein the studs are also arranged in rows, extending substantially transverse to the opposite edges, wherein a ratio of studs to free area in a row of studs adjacent to, but spaced from, the centre of the rail seat portion is greater than that in a row further from the centre.

According to the present invention there is provided a railway rail pad for location between a foot of a railway rail and an underlying rail foundation, the pad having a rail seat portion for receiving a foot of a railway rail, two opposite edges of which rail seat portion extend parallel to the longitudinal axis of the rail when the pad is in use, which rail seat portion is provided with a plurality of studs on at least one major face thereof, wherein the studs are unevenly distributed across the said face of the rail seat portion such that a ratio of the area of said face occupied by said studs to the area of said face free of said studs is greater in an edge region of the rail seat portion than in a central region of the rail seat portion, said edge region being adjacent to one of said edges and said central region being adjacent to said edge region; wherein the studs are arranged in columns, extending substantially parallel to said opposite edges, each stud being of substantially the same size, and

the number of studs in a column in the central region which is closest to said edge region being greater than in a column closer to the centre of the rail seat portion, and wherein the studs are also arranged in rows, extending
5 substantially transverse to said opposite edges, wherein the ratio of protrusions to free area in a row of studs adjacent to, but spaced from, the centre of the rail seat portion is greater than that in a row further from the centre.

10 Such a pad may have reduced stiffness as compared to a conventional pad, in which the ratio is constant over substantially all of the rail seat region, whilst restricting rail roll and pad wear to an acceptable level, particularly in the edge region of the pad which is that
15 part of the pad subject to the greatest loading and therefore most susceptible to wear.

Preferably the ratio is also greater in another edge region of the rail seat portion, adjacent to the other of the edges, than in the said central region.

20 In a preferred embodiment, the area of each of the studs is the same and the spacing between the studs varies.

The studs are preferably distributed symmetrically with respect to a first centre line of the rail seat portion extending parallel to the said longitudinal rail axis.

25 Desirably, the studs are also distributed symmetrically with respect to a second centre line of the rail seat portion extending perpendicular to the said longitudinal rail axis.

Reference will now be made, by way of example, to the
30 accompanying drawings, in which:

Figure 1A shows a plan view of a pad embodying the present invention;

Figure 1B shows a side view of the pad of Fig. 1A;

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Figure 1C shows an end view of the pad of Fig. 1A;

Figure 1D shows a perspective view of the pad of Fig. 1A;

Figure 2 shows a plan view of a first alternative pad
5 embodying the present invention; and

Figure 3 shows a plan view of a second alternative pad embodying the present invention.

As shown in Figs. 1A to 1D a pad 1 embodying the
present invention has an approximately rectangular rail
10 seat portion 2 and four ear portions 3a, 3b, 3c, 3d formed respectively at the four corners of the rail seat portion 2. The ears 3a, 3b, 3c, 3d serve to locate the pad 1 on a rail foundation (not shown) with respect to clip anchoring
shoulders (not shown). When the pad is in use beneath a
15 rail, a first edge 2a of the rail seat portion 2 between the ears 3a and 3b and a second edge 2b of the rail seat portion between the ears 3c and 3d lie transverse to the longitudinal axis of the rail and a third edge 2c of the
rail seat portion 2 between the ears 3a and 3c and a fourth
20 edge 2d of the rail seat portion between the ears 3b and 3d lie substantially parallel to the longitudinal axis of the rail (not shown).

The rail seat portion 2 has two major faces 4A, 4B on each of which are formed a plurality of studs 5 of
25 substantially circular cross-section and equal size. The studs 5 are distributed unevenly across each major face, in register with studs 5 on the other major face, such that the ratio of the area occupied by the studs 5 on the face of the rail seat portion 2 to the area of that face free of
30 studs 5 is greater in edge regions 6a, 6b of the rail seat portion 2 than in a central region 7 of the rail seat portion 2, the edge regions 6a, 6b being adjacent respectively to the third and fourth edges 2c, 2d of the

5 rail seat portion 2 and the central region 7 being adjacent to the edge regions 6a, 6b. The ratio decreases gradually across the rail seat region 2 from the edges 2c, 2d to the centre 2e of the rail seat region 2. In this way, the stiffness of the pad is reduced whilst restricting rail roll and pad wear to an acceptable level.

10 In this embodiment the desired ratio, and hence pad characteristics, is obtained by selecting the number and location of the studs 5 in the edge and central regions 6a, 6b, 7.

15 In particular, in the pad 1, the studs 5 are arranged in columns parallel to the edges 2c, 2d of the rail seat portion 2. There are 7 columns a1 to a7 parallel to the edges 2c, 2d. As shown in Fig. 1A there are 9 studs in columns a1 and a7, 6 studs in columns a2 and a6, 4 studs in columns a3 and a5 and 4 studs in column a4. Thus, the number of studs in a column in the central region 7 which is closest to the edge region 6a, 6b is greater than in a column closer to the centre 2e of the rail portion 2a.

20 The studs in columns a1 to a7 are also arranged in rows parallel to the edges 2a, 2b. There are 9 rows b1 to b9. As shown in Fig. 1A there are 5 studs in rows b1 and b9, 4 studs in rows b2 and b8, 5 studs in rows b3 and b7, 6 studs in rows b4 and b6, and 2 studs in row b5. Thus, in this embodiment, the ratio of protrusions to free area in a row of studs adjacent to, but spaced from, the centre 2e of the rail seat portion 2 is greater than that in a row further from the centre.

25 In total the pad 1 has 42 studs on each face 4A and 4B of the pad 1.

The pattern of studs 5 is such that they are arranged symmetrically with respect to the two centre lines CL1, CL2

of the rail seat portion 2. Column a4 lies on the centre line CL1 and row b5 lies on the centre line CL2.

In this way, the pad can be used correctly either way round on the rail foundation provided that the ears 3a to 3d are located on the clip anchoring shoulders. The pad 1 has a retention lip 8 between ears 3a and 3c along edge 2c and another retention lip 8 between ears 3b and 3d along edge 2d, to hold the pad down and make it captive in a rail fastening assembly. If these lips 8 were not required and were omitted, since the pattern of studs 5 on each major face 4A, 4B of the rail seat portion is the same, the pad could also be used either way up.

Another embodiment of the pad has additional studs 5 placed, for example, in column a4, at rows b2 and b8, and in columns a3 and a5, at row b5, to adjust the stiffness of the pad as required. Such a pad 1' is shown in Figure 2. This pad has a total of 46 studs.

Table 1 below shows the respective ratios of protrusions to free area for pads A, B, C and D of different sizes and having different numbers of studs.

The pad 1 shown in Figure 1 is a pad of type A and the pad 1' shown in Figure 2 is a pad of type B. Figure 3 shows a pad 1'' of type C.

In one embodiment of pad 1, having a rail seat portion 2 of thickness 5.3mm in a part between studs 5 and of thickness 9mm in a part having studs 5, the pad was made of EVA material of a grade having approximately 9% VA content. The dynamic stiffness of the pad was 193.8kN/mm. Under a standard 3 million cycle inclined wear test the pad stiffened 16.8%. In comparison a softer pad, made of EVA material of a grade having approximately 14% VA content, and having 62 studs of the same size, had a dynamic

stiffness of 196kN/mm but stiffened in the wear test to a much larger degree, 27.8%.

TABLE 1

5

	Pad A	Pad B	Pad C	Pad D
Pad Size	145 x 150 mm		145 x 125mm	
No. of Studs/ Diameter	42/10mm	46/10mm	42/10mm	46/10mm
Width of Edge Region	21.45 mm	21.45mm	17.84 mm	17.84mm
Area of Edge Region	3144.31mm ²	3144.31mm ²	2586.8mm ²	2586.8mm ²
Area of Studs in Edge Region	706.86 mm ²	706.86mm ²	706.86mm ²	706.86mm ²
Area of Edge Region free of Studs	2437.45mm ²	2437.45mm ²	1879.94mm ²	1879.94mm ²
Ratio of Stud Area to Free Area in Edge Region	0.29	0.29	0.38	0.38
Width of Central Region	107.07mm	107.07mm	89.34mm	89.34mm
Area of Central Region	15527.12mm ²	15527.12mm ²	12954.3mm ²	12954.3mm ²
Area of Studs in Central Region	1884.96mm ²	2199.12mm ²	1884.96mm ²	2199.12mm ²
Area of Central Region Free of Studs	13642.16mm ²	13328mm ²	11069.34mm ²	10755.18mm ²
Ratio of Stud Area to Free Area in Central Region	0.14	0.165	0.17	0.20

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A railway rail pad for location between a foot of a railway rail and an underlying rail foundation, the pad including:

5 a rail seat portion for receiving a foot of a railway rail, the rail seat portion including two opposite edges which extend parallel to a longitudinal axis of the rail when the pad is in use, the rail seat portion is provided with a plurality of studs on at least one major face thereof, wherein at least some of the studs are located along the centre line parallel to the longitudinal axis of the rail or wherein substantially no studs are located in the inner region of the centre line which lies
10 perpendicular to the longitudinal axis of the rail, wherein the studs are unevenly distributed across the face of the rail seat portion such that a ratio of the area of the face occupied by the studs to the area of the face free of the studs is greater in an edge region of the rail seat portion than in a central region of the rail seat portion with the edge region being adjacent to one of the edges wherein the
15 central region is adjacent to the edge region;

wherein the studs are arranged in columns, extending substantially parallel to the opposite edges, each stud being of substantially the same size, and the number of studs in a column in the central region which is closest to the edge region being greater than in a column closer to the centre of the rail seat portion, and

20 wherein the studs are also arranged in rows, extending substantially transverse to the opposite edges, wherein a ratio of studs to free area in a row of studs adjacent to, but spaced from, the centre of the rail seat portion is greater than that in a row further from the centre.

2. A pad as claimed in claim 1, wherein the ratio of the area of the face
25 occupied by the studs to the area of the face free of the studs is also greater in another edge region of the rail seat portion, adjacent to the other of said edges, than in the central region.

3. A pad as claimed in claim 1 or 2, wherein the area of each of the studs is the same and the spacing between the studs varies.

4. A pad as claimed in any preceding claim, wherein the studs are distributed symmetrically with respect to a first centre line of the rail seat portion extending parallel to the said longitudinal rail axis.

5. A pad as claimed in claim 4, wherein the studs are distributed symmetrically with respect to a second centre line of the rail seat portion extending perpendicular to the said longitudinal rail axis.

6. A railway rail pad for location between a foot of a railway rail and an underlying rail foundation, the pad including:

a rail seat portion for receiving a foot of a railway rail,
the rail seat portion having two opposite edges which extend parallel to a longitudinal axis of the rail when the pad is in use,
the rail seat portion including a plurality of studs on at least one major face thereof,

wherein at least some of the studs are located along the centre line parallel to the longitudinal axis of the rail or

wherein substantially no studs are located in the inner region of the centre line which lies perpendicular to the longitudinal axis of the rail,

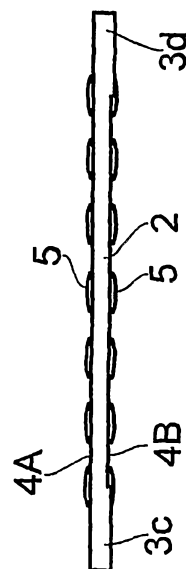
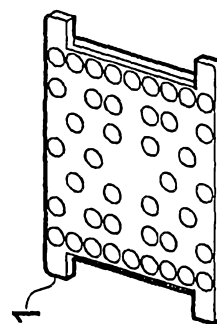
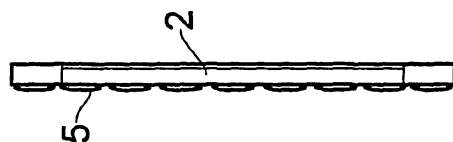
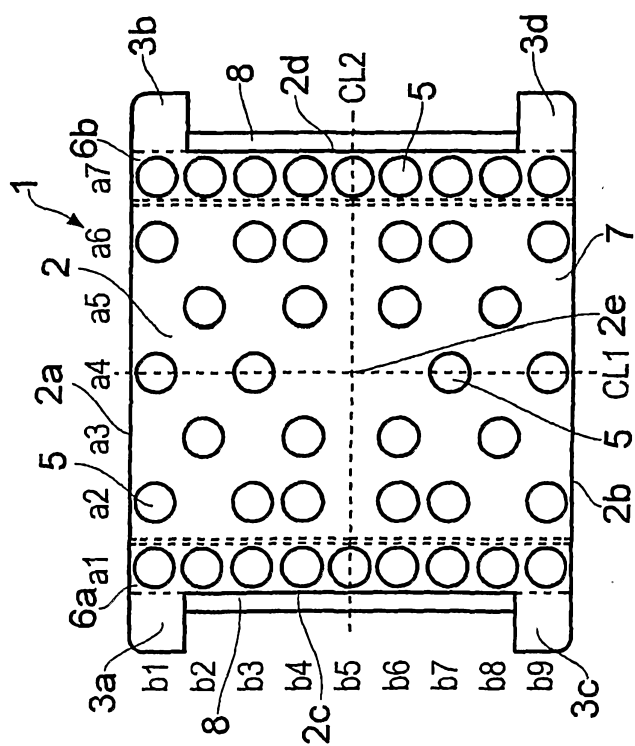
wherein the studs are unevenly distributed across the face of the rail seat portion such that a ratio of the area of the face occupied by the studs to the area of the face free of the studs is greater in an edge region of the rail seat portion than in a central region of the rail seat portion.

7. A railway rail pad for location between a foot of a railway rail and an underlying rail foundation substantially as herein described with reference to accompanying drawings.

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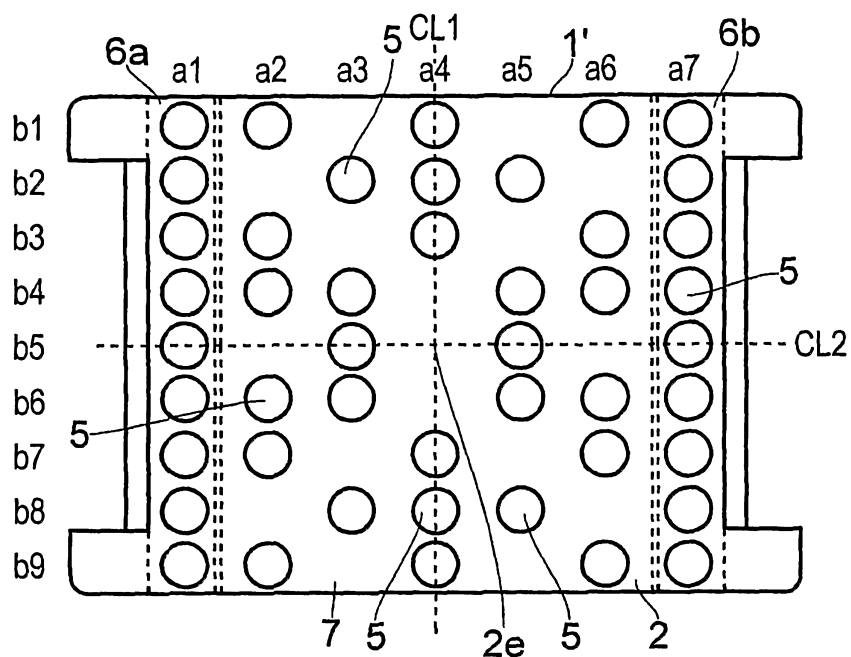


FIG. 2

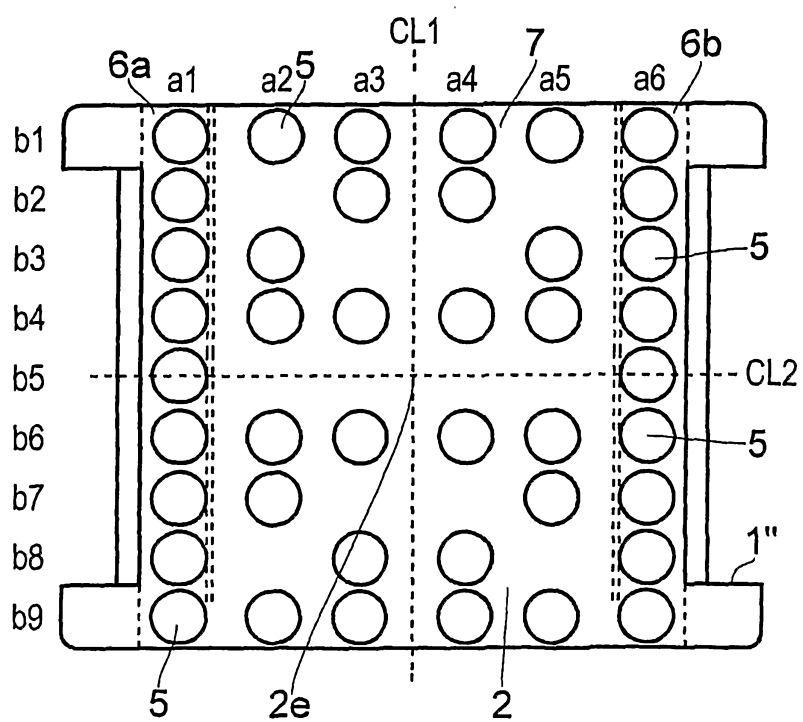


FIG. 3