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D E C I S I O N
of 12 July 2005

Case Number: T 1031/04 - 3.2.2

Application Number: 00400078.2

Publication Number: 1020536

IPC: C21D 9/00

Language of the proceedings: EN

Title of invention:
Screw having selected heat treatment and hardening

Applicant:
Illinois Tool Works Inc.

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step - (yes, after amendments)"

Decisions cited:
-

Catchword:
-

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Case Number: T 1031/04 - 3.2.2

D E C I S I O N
of the Technical Board of Appeal 3.2.2
of 12 July 2005

Appellant: Illinois Tool Works Inc.
3600 West Lake Avenue
Glenview, Cook County
Illinois 60025 (US)

Representative: Gérard Bloch
2 Square de l'Avenue du Bois
F-75116 Paris (FR)

Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 29 March 2004 refusing European application No. 00400078.2 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: T. Kriner
Members: D. Valle
U. J. Tronser

Summary of Facts and Submissions

I. The appellant (applicant) lodged an appeal on 17 May 2004 against the decision of the examining division posted on 29 March 2004 refusing the European patent application 00400078.2. The fee for the appeal was paid simultaneously and the statement setting out the grounds for appeal was received on 12 July 2004.

II. The examining division held that the application did not meet the requirement of Articles 52 and 56 EPC (lack of inventive step) having the regard to the teaching of

D1 = GB - A - 502 152 or
D2 = US - A - 2 086 801, and
D3 = EP - A - 0 563 826.

III. Additionally the following documents have been considered during the appeal proceedings:

D4 = US - A - 5 755 542
D5 = US - A - 5 605 423
D6 = US - A - 4 730 970
D7 = DE - C - 684 060
D8 = US - A - 3 376 780
D9 = US - A - 4 295 351
D10= US - A - 4 289 006
D11= US -A - 2 229 565.

IV. Oral proceedings took place on 12 July 2005.

The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of:

claims: 1 to 15 and
description: columns 1, 2, 5 and 6

as submitted during oral proceedings;

description: columns 3, 4 and 7 and
Figures: 1 to 11

as published.

V. The application contains independent claims 1, 4 and 7.

Claim 1 reads as follows:

"A selectively hardened cold heading grade low carbon steel screw, the carbon content ranging from about 0,18 - 0,35 % by weight of steel, the screw comprising a screw head (12), a shank (14) having a first end adjacent the head (12) and a second end (46), and a screw tip (16) adjacent the second end (46), of the shank (14), the screw head (12) including a top surface (24), a bottom (26), a center region (28), an outer rim (30) and a recess (32, 34), in the center region (28), for receiving a driving tool; the screw head (12) including an upper selectively flame hardened portion with a martensitic metallurgical structure on the top surface (24) in the center region (28), and a lower portion which has not been hardened, with a ferritic

perlitic metallurgical structure on the bottom (26), the shank (14) including an upper portion which has not been hardened, with a ferritic perlitic metallurgical structure at the first end and a martensitic metallurgical structure at the second end (46) which has been hardened, wherein the screw tip (16) is also selectively flame hardened with a martensitic metallurgical structure."

Claim 4 reads as follows:

"A selectively hardened cold heading grade low carbon steel drill tip screw, the carbon content ranging from about 0,18 - 0,35 % by weight of steel, the screw comprising a screw head (62), a shank (64) having a first (66) end adjacent the head (62) and a second end (67), and a screw tip (68) adjacent the second end (67) of the shank (64); the screw head (12) including an upper selectively flame hardened portion with a martensitic metallurgical structure on its exterior face, and a lower portion which has not been hardened; the shank (64) including an upper portion (66) which has not been hardened and a lower selectively hardened portion (67) adjacent the tip (68), wherein the screw tip (68) is also selectively flame hardened, second end (67) of the shank (64) and the tip (68) having a metallurgical structure."

Claim 7 reads as follows:

"A selectively hardened cold heading grade low carbon steel hex-head screw, the carbon content ranging from about 0,18 - 0,35 % by weight of steel, the screw comprising a screw head (74), a shank (86) having a

first end adjacent the head and a second end, a screw tip adjacent the second end of the shank (86), and a permanent washer (84) between the screw head (74) and the shank (86); the screw head (74) having a top surface (76) and outer faces (82), the screw head (74) including an upper selectively flame hardened portion with hardened outer faces (82) and a lower portion which has not been hardened; the shank (86) including an upper portion which has not been hardened, wherein the screw tip is also selectively flame hardened."

VI. In support of his request the appellant relied essentially on the following submissions.

The subject-matter of the independent claims 1, 4 and 7 involved an inventive step, since no documents of the available state of the art contained sufficient hints in order to lead the skilled person to the combination of features presented in the claimed invention.

Reasons for the Decision

1. The appeal is admissible.

2. *Amendments*

Claim 1 is based on the original claims 1 and 3, on Figures 1 and 3 and on the description, page 6, lines 7 to 9 and lines 5 to 1 from the bottom, page 8, second paragraph, page 11, third paragraph.

Claim 4 is based on Figure 4, on the corresponding passages in the descriptions and on the description, page 6, lines 7 to 9 and lines 5 to 1 from the bottom, page 8, second paragraph, page 11, third paragraph.

Claim 7 is based on Figure 5, on the corresponding passages in the descriptions and on the description, page 8, second paragraph, page 11, third paragraph.

Claim 2 is based on the Figures 1 and 2. Claim 3 is based on Figure 3. Claim 5 is based on page 10, first full paragraph. Claim 6 is based on Figure 4. Claims 8 to 10 are based on claims 9 to 11. Claims 11 to 14 are based on the description, full page 6, to page 7, second full paragraph, and on page 9, first full paragraph, to page 10, line 1. Claim 15 is based on page 10, first paragraph.

The description has been adapted to the new filed claims.

Consequently the amendments made are allowable with respect to Article 123(2) EPC.

3. *Novelty*

3.1 Novelty of claim 1

D1 discloses a selectively hardened carbon steel screw, the screw comprising a screw head, a shank having a first end adjacent the head and a second end, and a screw tip adjacent the second end of the shank, the screw head including a top surface (1), a bottom, a center region and an outer rim; the screw head

including an upper selectively flame hardened portion on the top surface in the center region, and a lower portion (2) which has not been hardened, the upper portion having on the top surface in the center region a martensitic metallurgical structure and the bottom having a ferritic perlitic metallurgical structure (implicit), the shank including an upper portion which has not been hardened, with a ferritic perlitic metallurgical structure at the first end (implicit).

However, D1 does not disclose that the screw is a cold heading grade low carbon steel screw, the carbon content ranging from about 0,18 - 0,35 % by weight of steel, the screw head including a recess in the center region for receiving a driving tool; that the second end of the shank has been hardened and has a martensitic metallurgical structure and that the screw tip is also selectively flame hardened with a martensitic metallurgical structure.

D2 is less relevant than D1 failing to disclose in comparison to D1 also the feature that the screw is flame hardened.

D3 discloses a carbon steel screw, the screw comprising a screw head (19), a shank (18) having a first end adjacent the head and a second end, and a screw tip (23) adjacent the second end of the shank, the screw head including a top surface, a bottom, a center region, an outer rim and a recess in the center region for receiving a driving tool; the shank including an upper portion which has not been hardened, wherein the screw tip is selectively flame hardened.

However, D3 fails to disclose that the screw is a selectively hardened cold heading grade low carbon steel screw, the carbon content ranging from about 0,18 - 0,35 % by weight of steel, the screw head (12) including an upper selectively flame hardened portion with a martensitic metallurgical structure on the top surface (24) in the center region (28), and a lower portion which has not been hardened, with a ferritic perlitic metallurgical structure on the bottom (26), the shank having a ferritic perlitic metallurgical structure at the first end and a martensitic metallurgical structure at the second end.

D4 discloses the same features of claim 1 as D3 and additionally, that the screw is made by cold heading (see column 5, lines 27 to 30).

D5 is less relevant than D3 since it does not disclose the feature of claim 1 that the head has a recess in the center region, for receiving a driving tool.

D6 discloses the same features of claim 1 as D3.

D7 discloses the same features of claim 1 as D1.

D8 discloses the same features of claim 1 as D3.

D9 and D10 are less relevant, since they neither disclose that the screw head includes an upper selectively hardened portion and a lower portion which has not been hardened, nor that the screw tip is selectively hardened.

D11 discloses a selectively hardened carbon steel screw, the screw comprising a screw head (4), and a shank (3) having a first end adjacent the head and a second end, the screw head including a top surface, a bottom, a center region, an outer rim and a recess (2) in the center region for receiving a driving tool; the screw head including an upper selectively flame hardened portion (1) on the top surface, and a lower portion which has not been hardened, wherein the upper hardened portion of the screw head has a martensitic metallurgical structure on the top surface in the center region, and the bottom has a ferritic perlitic metallurgical structure (implicit).

However, D11 does not disclose that the screw is a cold heading grade low carbon steel screw, the carbon content ranging from about 0,18 - 0,35 % by weight of steel, the shank including an upper portion which has not been hardened, with a ferritic perlitic metallurgical structure at the first end and a martensitic metallurgical structure at the second end which has been hardened, wherein the screw comprises a screw tip adjacent the second end of the shank which is also selectively flame hardened so that it has a martensitic metallurgical structure.

3.2 Novelty of claim 4

D1 discloses a selectively hardened carbon steel screw, the screw comprising a screw head, a shank having a first end adjacent the head and a second end, and a screw tip adjacent the second end of the shank; the screw head including an upper selectively flame hardened portion, and a lower portion which has not

been hardened, wherein the upper selectively flame hardened portion has a martensitic metallurgical structure on its exterior face.

However, D1 does not disclose that the screw is a cold heading grade low carbon steel drill tip screw, the carbon content ranging from about 0,18 - 0,35 % by weight of steel, that the shank includes an upper portion which has not been hardened and a lower selectively hardened portion adjacent the tip, wherein the screw tip is also selectively flame hardened and the second end of the shank and the tip have a (martensitic) metallurgical structure.

D2 is less relevant than D1 failing to disclose in comparison to D1 also the feature that the screw is flame hardened.

D3 discloses a selectively hardened carbon steel drill tip screw, the screw comprising a screw head (19), a shank (18) having a first end adjacent the head and a second end, and a screw tip adjacent the second end of the shank; the shank including an upper portion which has not been hardened, wherein the screw tip is selectively flame hardened, the tip having a (martensitic) metallurgical structure.

However, D3 does not disclose that the screw is a cold heading grade low carbon steel screw, the carbon content ranging from about 0,18 - 0,35 % by weight of steel, the screw head including an upper selectively flame hardened portion with a martensitic metallurgical structure on its exterior face, and a lower portion which has not been hardened and the shank including a

lower selectively hardened portion adjacent the tip having a (martensitic) metallurgical structure.

D4 discloses the same features of claim 4 as D3 and additionally, that the screw is made by cold heading (see column 5, lines 27 to 30).

D5 and D6 disclose the same features of claim 4 as D3.

D7 discloses the same features of claim 4 as D1.

D8 discloses the same features of claim 4 as D3.

D9 and D10 are less relevant, since they neither disclose that the screw head includes an upper selectively hardened portion and a lower portion which has not been hardened, nor that the screw tip is selectively hardened.

D11 discloses a selectively hardened carbon steel screw, the screw comprising a screw head, and a shank having a first end adjacent the head and a second end; the screw head including an upper selectively flame hardened portion with a martensitic metallurgical structure on its exterior face, and a lower portion which has not been hardened.

However, D11 does not disclose that the screw is a cold heading grade low carbon drill tip steel screw, the carbon content ranging from about 0,18 - 0,35 % by weight of steel, the screw comprising a screw tip adjacent the second end of the shank; the shank including an upper portion which has not been hardened and a lower selectively hardened portion adjacent the

tip, the second end of the shank and the tip having a (martensitic) metallurgical structure, wherein the screw tip is also selectively flame hardened.

3.3 Novelty of claim 7

D1 discloses a selectively hardened carbon steel hex-head screw, the screw comprising a screw head, a shank having a first end adjacent the head and a second end, and a screw tip adjacent the second end of the shank; the screw head having a top surface, and outer faces and including an upper selectively flame hardened portion, and a lower portion which has not been hardened, wherein the shank includes an upper portion which has not been hardened.

However, D1 does not disclose that the screw is a cold heading grade low carbon steel screw, the carbon content ranging from about 0,18 - 0,35 % by weight of steel, the screw comprising a permanent washer between the screw head and the shank, that the upper selectively flame hardened portion has hardened outer faces, and that the screw tip is also selectively flame hardened.

D2 is less relevant than D1 failing to disclose in comparison to D1 also the feature that the screw is flame hardened.

D3 discloses a selectively hardened carbon steel screw, the screw comprising a screw head (19), a shank (18) having a first end adjacent the head and a second end, and a screw tip adjacent the second end of the shank; the screw head having a top surface, and outer faces

and including an upper portion and a lower portion, the shank including an upper portion which has not been hardened, wherein the screw tip is selectively frame hardened.

However, D3 does not disclose that the screw is a cold heading grade low carbon steel hex-head screw, the carbon content ranging from about 0,18 - 0,35 % by weight of steel, the screw comprising a permanent washer between the screw head and the shank, the screw head including an upper selectively flame hardened portion, and a lower portion which has not been hardened.

D4 discloses the same features of claim 7 as D3 and additionally, that the screw is made by cold heading (see column 5, lines 27 to 30).

D5 and D6 disclose the same features of claim 7 as D3.

D7 discloses the same features of claim 7 as D1.

D8 discloses the same features of claim 7 as D3.

D9 and D10 are less relevant, since they neither disclose that the screw head includes an upper selectively hardened portion and a lower portion which has not been hardened, nor that the screw tip is selectively hardened.

D11 discloses a selectively hardened carbon steel screw, the screw comprising a screw head, a shank having a first end adjacent the head and a second end, a screw tip adjacent the second end of the shank, the

screw head having a top surface and outer faces, the screw head including an upper selectively flame hardened portion with hardened outer faces and a lower portion which has not been hardened, wherein the shank includes an upper portion which has not been hardened.

However, D11 does not disclose that the screw is a cold heading grade low carbon steel hex-head screw, the carbon content ranging from about 0,18 - 0,35 % by weight of steel, the screw having a permanent washer between the screw head and the shank, wherein the screw tip is also selectively flame hardened.

4. *Inventive step*

4.1 Starting from D4, which is considered to represent the closest state of the art, the object underlying the present application has to be seen in improving the known screw.

This object is achieved by the combination of the distinguishing features of claims 1, 4 or 7, respectively, in particular by

(i) the provision of a grade low carbon steel screw, the carbon content ranging from about 0,18 - 0,35 % by weight of steel,

(ii) the screw head including an upper selectively flame hardened portion, and a lower portion which has not been hardened.

Feature (ii) might be regarded as obvious, since it is disclosed for example in D1. However, no document of

the available state of the art suggests using a steel according to feature (i) for a screw of the type disclosed in D4.

4.2 With respect to the above findings, the subject-matter of the independent claims 1, 4 and 7 is novel and involves an inventive step.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to grant a patent on the basis of:

Claims: 1 to 15 and
Description: columns 1, 2, 5 and 6

as submitted during oral proceedings,

Description: columns 3, 4 and 7 and
Figures: 1 to 11

as published.

The Registrar: The Chairman:

V. Commare T. Kriner