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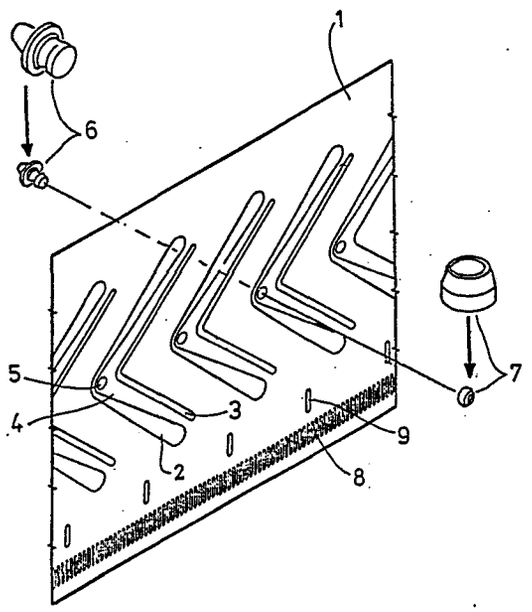
(54) Method and tool for attaching print elements to the band of a dot band printer.

(57) Method and tool for attaching print elements to the band of a dot band printer whereby a print element (6) is secured to a print band (1) by pressing a collar (7) in an entirely radial direction against the cylindrical part (26) of the print element so that the material of the collar (7) flows into a necded-down portion (23) of said cylindrical portion (26).



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METHOD AND TOOL FOR ATTACHING PRINT ELEMENTS TO THE BAND OF A DOT BAND PRINTER.

The invention described and claimed herein relates to a method and a tool for attaching print elements to a print band in a dot printer.

Prior known methods for attaching print elements to a metal band include resistance spot welding, laser welding and brazing. In all these processes the thin printband is subjected to extreme heat which causes stresses in the material. Thus, further heat treatment processes are needed in order to remove said stresses in the band material. Also a laser heat treatment of each individual print element to harden them is needed. In summary, this manufacturing processes are very complicated, time consuming and as a consequence thereof very expensive.

It is further prior known from US Patents 4.299.519 and 4.233.879 in combination with 3.645.125 to secure two plates together by riveting or swaging using a two part member. These patents describe a two piece fastener and an installation tool for securing two thin plates together using a pin and a swageable collar. The tool exerts an axial pulling force on the pin and reaction force on the collar so as to swage the collar into engagement with the

pin. This method is not applicable for attaching print elements to a thin print band as the axial forces will cause dammages to the print band.

The invention as claimed is intended to remedy the above mentioned drawbacks. It solves the problem of how to attach print elements to a thin steel band of a dot matrix printer without causing damages to the print band or changing the metallurgical properties of the parts by means of a special tool which exerts an entirely radial force to swage a collar inwardly to conform to a recess of the print element.

The advantages offered by the invention are mainly that by the use of the new tool the print elements can be attached to the thin steel print band in a fast and economical way without exposing the band to heat or stress which can cause irreparable damages and causes need of further process steps to get rid of stresses in the band. Further, with the new method the print band is not subjected to axial forces from the tool.

The invention, which is defined in the attaced claims, is described in detail below with reference to the drawings in which:-

Figure 1 shows a typical print band for a dot band printer and an exploded view of a print element and a collar;

Figure 2 shows a first alternative attachment of a print element to a print band;

Figure 3 shows a second alternative attachment of a print element to a print band;

Figure 4 shows a schematical view of a tool for fastening a print element to a print band and

Figure 5 shows enlarged pictures of crosscuts of a print element fastened to a print band.

Figure 1 shows a typical print band 1 made in thin hardened steel. The print band is provided with openings 2 and 3 forming tongues 4 having holes 5 for attachment of print elements 6. The print band is also provided with timing slots 8 and 9. Figure 1 also shows an exploded view of the print element 6 and the collar 7 for attaching the print element to the print band.

Figure 2 A shows a first alternative form of a print element 6. The print element, which is made of hardened steel, is provided with a cylindrical part 26 having a necked-down portion 23, a flange 24 and an anvil surface 22 and a dot impactor part 25. The cylindrical part 26 of the print element is inserted into the hole 5 of the print band 1 and held in a fixed position with flange 24 slightly pressed against the print band. A swageable collar 27 of unhardened steel is threaded over the cylindrical

part 26 to contact with the print band 1 and thereafter radially pressed against the cylindrical part 26 so that the material flows into the necked-down portion 23 and thereby mechanically locks the print element to the print band. Figure 2 B shows a schematical cross-sectional wiew of such a print element fastened to the printbelt.

Figure 3 A shows a second alternative form of a print element 6. In this embodiment the print element consists of a dot impactor part 34, a cylindrical part 36 with a necked down portion 33 and an anvil part 31 with an anvil surface 32. The diameter of the anvil part 31 is greater than the diameter of the cylindrical part 36 and therefore the anvil part also serves as a flange. The print element is mechanically attached to the print band in the same way as described above in connection with figure 2. Figure 3 B shows a schematical cross-sectional view of a second type print element fastened to the print band.

Figure 4 shows in schematic form a tool for fastening the print elements 6 to the print band 1. The tool comprises an outer cylindrical collet 41, a trisectional jaw 42 and an axially movable, cylindrical wedge 43. The cylindrical collet 41 is provided with an inwardly extending annular flange 41' having an annular pivot edge 44. The trisectional jaw 42 comprises three parts separated from each other by slots and forming a rotational body comprising an upper portion 45, an intermediate portion 46 and a lower portion 47. The upper cylindrical portion 45 of the body has an

outer diameter substantially less than the inner diameter of the cylindrical collet 41 and an inner diameter d and a lower inwardly sloping surface 48. The intermediate portion 46 of said body has an outer cylindrical surface 49 which together with the sloping surface 48 forms an annular nip 46', a first inner cylindrical surface 51 having a diameter d and a heigth of d/2 and a second inner cylindrical surface 52 having a smaller diameter. The two cylindrical surfaces 51 and 52 are joined by a plane surface 53. The lower portion 47 of the body forms a tapered cone having a cylindrical cavity 54 with a diameter slightly greater than the outer diameter of the swageable collar 7. The trisectional jaw 42 is pivotally journalled in the annular nip 46' around the pivot edge 44. The three parts of the jaw are held in a spaced relationship and in contact with the annular pivot edge 44 by a spherical steel member 58 having a diameter equal to the inner diameter d of the upper portion 45 of the body and its centre in the plane containing said annular pivot edge 44. The three jaw parts are separated from each other by equal slots 62a, 62b and 62c (Fig. 4B) by means not shown. Further, the jaw parts held in the position shown in figure 4A by resilient means (not shown). A cylindrical wedge 43 is axially movable via a piston 59 by a linear motor 55, e. g., a hydraulic or pneumatic motor, which is fixedly mounted to the cylindrical collet 41 by means of a plate 57. When the wedge 43 is moved downwards from the start position shown in figure 4A it presses the upper portions of the jaw parts apart. Then, by the lever effect the jaw tips 60 is moved inwardly.

Figure 4B is a cross-sectional view along line A-A i figure 4A with the spherical member 51 remowed showing the three parts 42a, 42b and 42c of the jaw 42 separated by the slots 62a, 62b and 62c.

The function of the tool 40 is as follows: A swageable collar 7 is inserted into the cavity 54 of the jaw 42 and the linear motor 55 is acttivated and moves the wedge downwards a short distance thereby gripping the swageable collar 7. The tool 40 is than moved so that the swageable collar 7 is threaded over the cylindrical part 26 of a print element 6 which has been inserted in a hole 5 of print band 1. The swageable collar is moved so that it slightly contacts the print band 1. With the tool in this position the linear motor 55 is again activated and moves the wedge 43 further downwards. By the lever effect the jaw tips 60 presses the swageable collar 7 radially inwards so that the material of the collar as described above flows into the necked-down portion 23 of the cylindrical part 26 of the print element 6. Excess material of the swageable collar 7 flows into the slots 62a, 62b and 62c between the jaw parts 42a, 42b and 42c. Thus, the print element 6 is mechanically secured to the print band 1 without exposing the print band to axial forces that may damage the print band.

Figure 5A is an enlarged picture of a cross-section of a collar 7 fastened to a print element 6 in accordance with the invention. The picture shows how material has flown out into the space between the jaw tips. Figure 5B is an enlarged picture of a

cross-section of a print element 6 fastened by a collar 7 to the print band 1 in accordance with the invention. The picture shows how material has flown into the necked-down portion 23 of the print element 6.

The invention is not to be limited by the embodiments shown in the drawings and described in the specification which are given by way of example and not of limitations.

CLAIMS

1. Method for attaching print elements to the band of a dot band printer,
characterized in that
a swageable collar (7) is swaged to a print element (6) by an entirely radial, inwardly directed force.

2. Method according to claim 1,

characterized in that

the print element (6) is provided with a cylindrical portion (26) having a necked-down portion (23) and in that the collar (7) is pressed against said cylindrical portion (26) so that material flows into said necked-down portion (23).

3. Method according to any of the preceding claims,

characterized in that

a multisectional jaw (42) is used to swage the collar whereby excess material flows into the slots (62) between the jaw parts (42a, 42b and 42c).

cross-section of a print element 6 fastened by a collar 7 to the print band 1 in accordance with the invention. The picture shows how material has flown into the necked-down portion 23 of the print element 6.

The invention is not to be limited by the embodiments shown in the drawings and described in the specification which are given by way of example and not of limitations.

CLAIMS

1. Method for attaching print elements to the band of a dot band printer,
characterized in that
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2. Method according to claim 1,

characterized in that

the print element (6) is provided with a cylindrical portion (26) having a necked-down portion (23) and in that the collar (7) is pressed against said cylindrical portion (26) so that material flows into said necked-down portion (23).

3. Method according to any of the preceding claims,

characterized in that

a multisectional jaw (42) is used to swage the collar whereby excess material flows into the slots (62) between the jaw parts (42a, 42b and 42c).

4. Tool for attaching print elements to the band of a dot band printer according to the method of claim 1,

characterized by

a cylindrical collet (41), a jaw (42) having at least two parts (42a, 42b) pivotally journalled on an annular flange (41') of said collet (41) and means (43) for operating the jaw (42).

5. Tool according to claim 4,

characterized in that

said means for operating the jaw (42) is a cylindrical wedge (43) reciprocally movable by means of a linear motor (55).

6. Tool according to claim 4 or 5,

characterized in that

the parts of the jaw (42) forms a rotational body having an upper portion 45, an intermediate portion 46 and a lower portion 47, whereby the upper portion (45) has a outer diameter substantially less than the inner diameter of the collet (41), an inner diameter d and a lower inwardly sloping surface (48), the intermediate portion (46) has outer cylindrical surface (49) which together with said sloping surface (48) forms an annular nip (46'), a first

inner cylindrical surface(51) having a diameter d and a height d/2 and a second inner cylindrical surface 52 having a smaller diameter and the lower portion (47) forms a tapered cylinder having a cylindrical cavity 54 having a diameter slightly greater than the diameter of a collar (7) which are to be swaged.

7. Tool according to clam 4 to 6, characterized in that

the jaw parts (42a,42b,42c) are held in a spaced relationship and with the nip (46') in contact with the annular pivot edge (44) by means of a spherical member (51) having a diameter equal to the inner diameter d of the upper portion (45) of said rotational body.

4. Tool for attaching print elements to the band of a dot band printer according to the method of claim 1,

characterized by

a cylindrical collet (41), a jaw (42) having at least two parts (42a, 42b) pivotally journalled on an annular flange (41') of said collet (41) and means (43) for operating the jaw (42).

5. Tool according to claim 4,

characterized in that

said means for operating the jaw (42) is a cylindrical wedge (43) reciprocally movable by means of a linear motor (55).

6. Tool according to claim 4 or 5,

characterized in that

the parts of the jaw (42) forms a rotational body having an upper portion 45, an intermediate portion 46 and a lower portion 47, whereby the upper portion (45) has a outer diameter substantially less than the inner diameter of the collet (41), an inner diameter d and a lower inwardly sloping surface (48), the intermediate portion (46) has outer cylindrical surface (49) which together with said sloping surface (48) forms an annular nip (46'), a first

inner cylindrical surface(51) having a diameter d and a height d/2 and a second inner cylindrical surface 52 having a smaller diameter and the lower portion (47) forms a tapered cylinder having a cylindrical cavity 54 having a diameter slightly greater than the diameter of a collar (7) which are to be swaged.

7. Tool according to clam 4 to 6, characterized in that

the jaw parts (42a,42b,42c) are held in a spaced relationship and with the nip (46') in contact with the annular pivot edge (44) by means of a spherical member (51) having a diameter equal to the inner diameter d of the upper portion (45) of said rotational body.

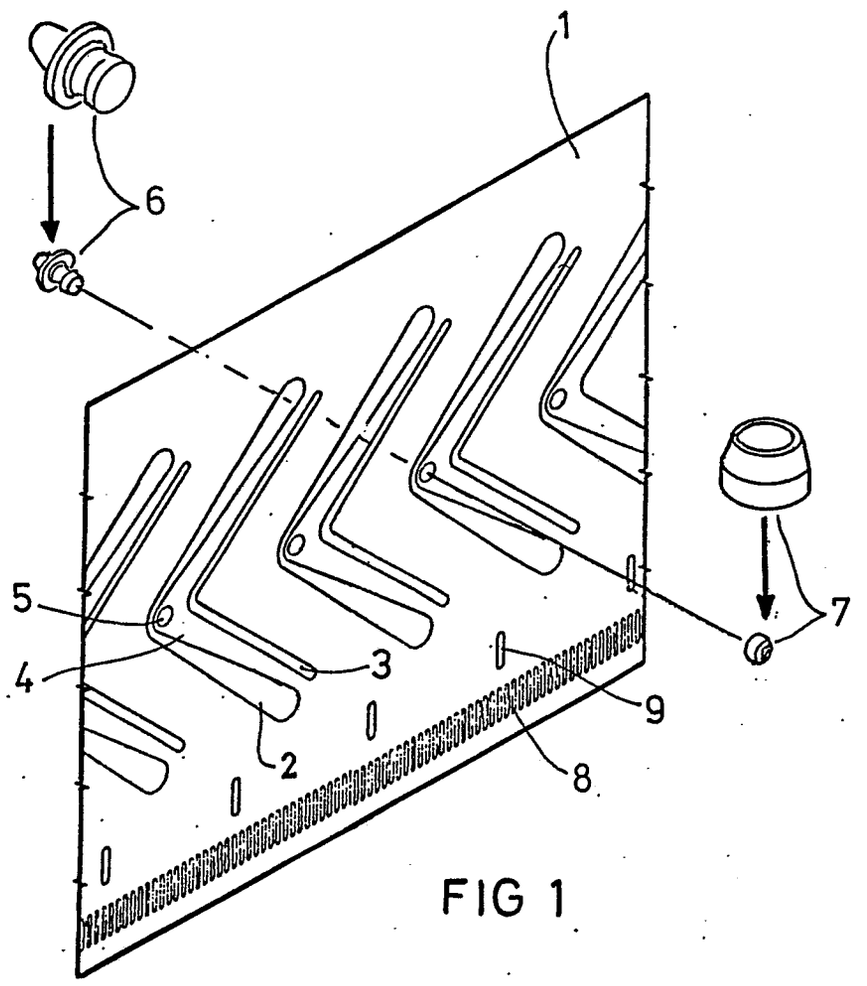

FIG 1

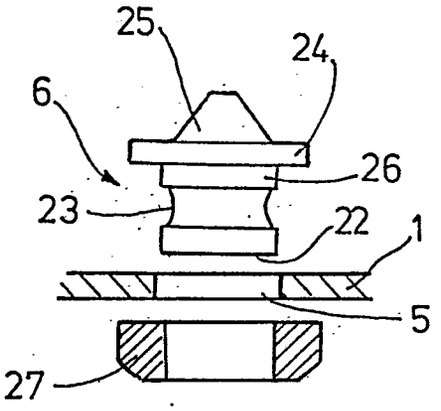

FIG 2A

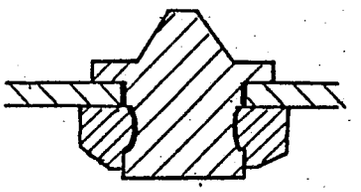

FIG 2B

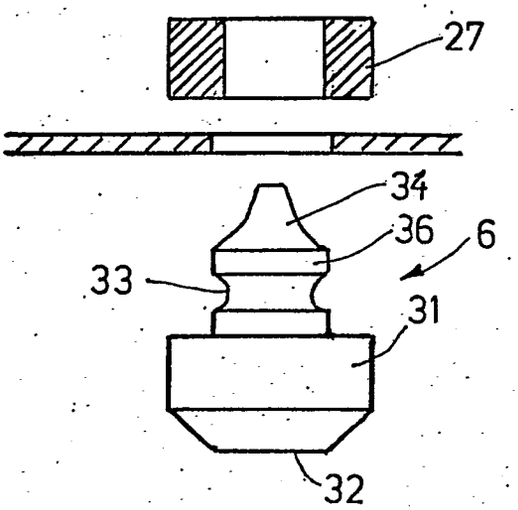

FIG 3A

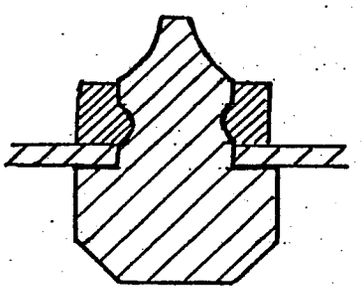

FIG 3B

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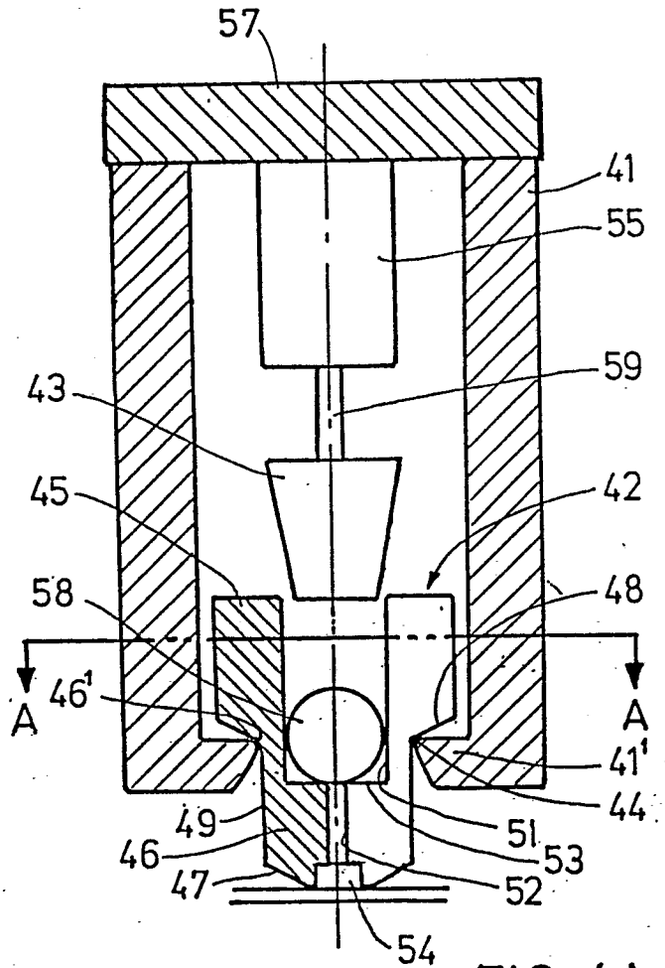

FIG 4A

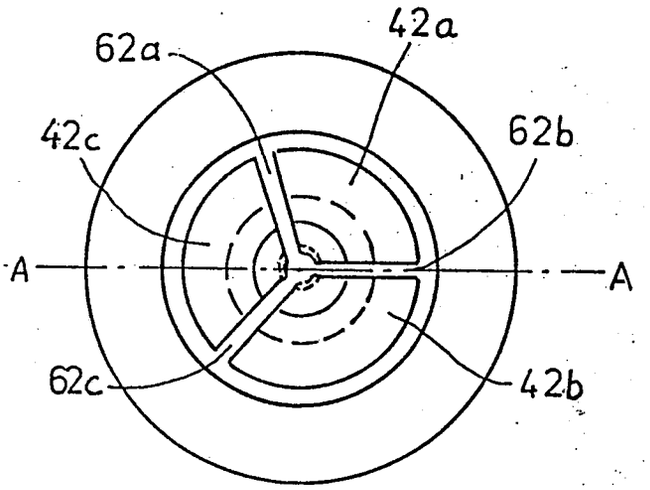

FIG 4B

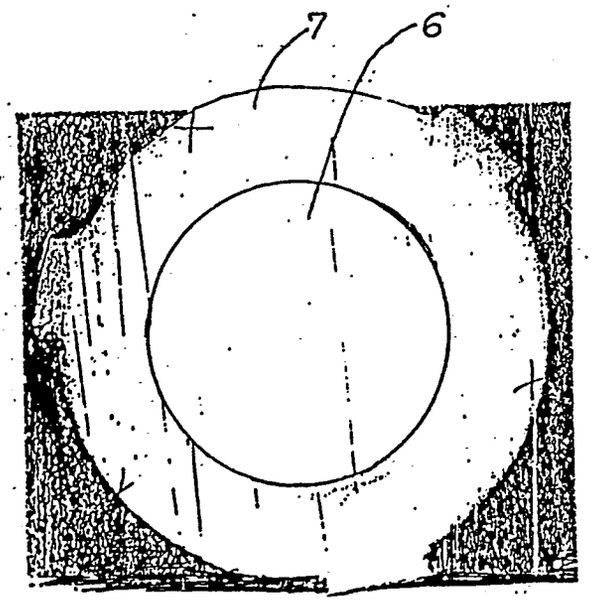

FIG 5A

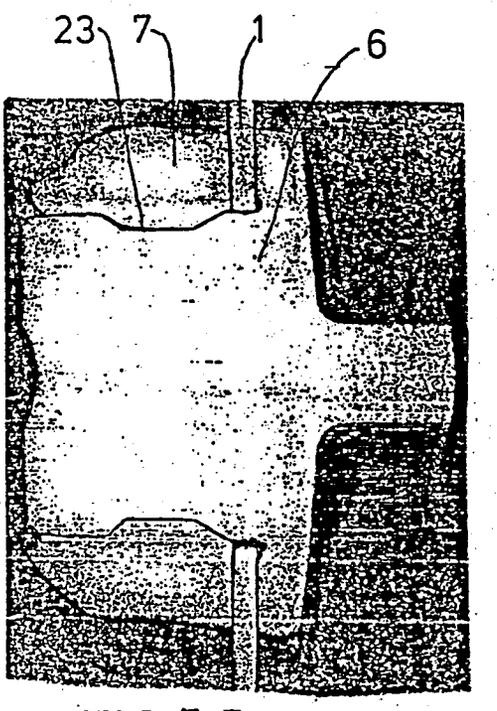

FIG 5B

European Patent Office

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Application number
EP 86105479.9

EUROPEAN SEARCH REPORT

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
D,A	US, A, 3 645 125 (F.A. SUMMERLIN), 29 February 1972	1-7	B 41 J 1/20 G 06 K 15/08 F 16 B 19/05
D,A	US, A, 4 299 519 (R.J. CORBETT), 10 November 1981	1-7	
A	US, A, 3 890 895 (J.R. DEPROUX), 24 June 1975	1-7	
A	DE, A1, 2 550 508 (S.H. BIENHOLZ), 13 May 1976	1-7	
A	IBM Technical Disclosure Bulletin, Vol. 27, No 4B, September 1984, E.F. HELINSKI, "Mechanically locked dot band attachment", p. 2604-2605.	1-7	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

B 41 J
G 06 K
F 16 B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
STOCKHOLM	15-09-1986	SILFVERLING J

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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