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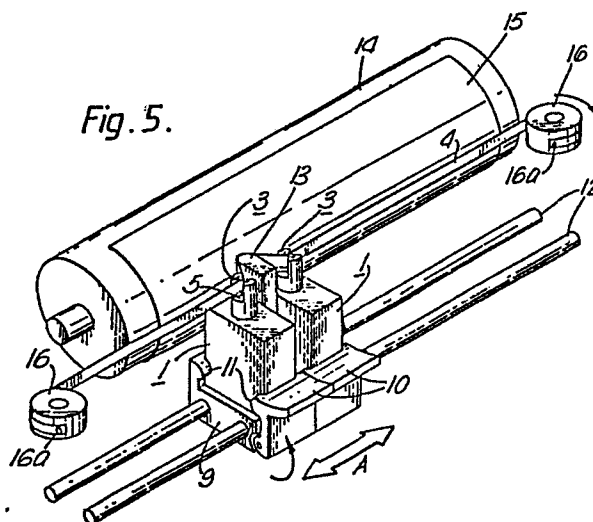
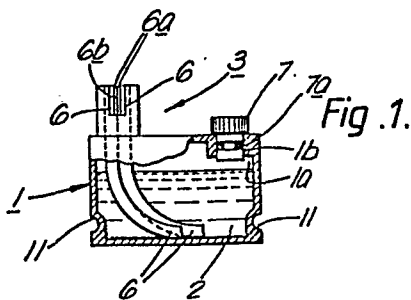
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54 **Printing head.**

57 A printing head comprising at least one housing (1) adapted to contain ink (2) and at least one ink supplying member (6) arranged to receive ink (2) from the or a respective housing (1) characterised by at least one film member (4) having a plurality of holes or recesses (4a)

therein, the or each film member (4) being arranged to receive ink from the respective ink supplying member or members (6) so that ink (2) is introduced into the said holes or recesses (4a).



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The present invention relates to a printing head.

In the conventional ink jet printer, a plurality of ink jet nozzles are used, and ink is jetted onto a printing paper by a piezo-electric drive means. In
5 such a conventional printer, however, it is very difficult to eliminate nozzle stoppage which, in effect, causes a white point to be printed on the printing paper.

On the other hand, in the case of an ink ribbon type printer, the ink is used in the course of time and
10 consequently the printing density gradually becomes paler.

Further, in the case of a thermal transfer printer or the hammer type printer, a coated tape has to be thrown away after one printing operation. Therefore, a printer or typewriter or wordprocessor which can print with a continuous
15 supply of ink has not been previously developed.

According to the present invention, there is provided a printing head comprising at least one housing adapted to contain ink and at least one ink supplying member arranged to receive ink from the or a respective housing, characterised
20 by at least one film member having a plurality of holes or recesses therein, the or each film member being arranged to receive ink from the respective ink supplying member or members so that ink is introduced into the said holes or recesses.

25 The or each film member may slidably engage a respective ink supplying member.

The or a said housing may have a film supporting member mounted thereon, the film supporting member having recess portions for guiding the, or the respective, film member.

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A cap member may be detachably mounted on the or each film supporting member so as to cover the outer surface thereof, the cap member having a slit portion for guiding the film member.

5 The or each housing may be provided with a pair of ink supplying members which are disposed on opposite sides of the film member, each ink supplying member having a curved portion to guide the film member towards a contact portion of the ink supplying member.

10 The or each housing may be provided with a detachable valve member for introducing ink into the housing.

The or each housing may also be provided externally with a mounting recess portion for detachably securing the housing to another member.

15 Preferably, the or each housing and the respective ink supplying member or members form part of a replaceable cassette for use in a printer.

20 Preferably, also there is at least one thermal head which engages the, or the respective, film member and which is adapted to heat ink in said holes or recesses so as to cause said ink to be jetted onto a recording medium by bubble pressure.

The thermal head may be disposed between two said housings.

25 Each thermal head may be provided with a plurality of heating dot elements.

The thermal head and the housing or housings may be integral with or secured to each other to constitute a replaceable cassette for use in a printer.

30 There may be a plurality of film members and respective thermal heads for printing a plurality of different colours.

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The or each film member may pass through a sealed space which is supplied with ink by a said ink supplying member.

5 The sealed space may be disposed between the housing and a member which is resiliently urged towards the housing, the sealed space being sealed by sealing members which engage opposite sides of the film member.

10 The or each ink supplying member may be connected to an ink reservoir by way of a frangible member, means being provided for breaking the frangible member to enable ink to pass from the ink reservoir to the ink supplying member.

The invention is illustrated, merely by way of example, in the accompanying drawings, in which:-

15 Figures 1 to 7 illustrate a first embodiment of a printing head according to the present invention,

Figure 1 is a cross sectional view, of a cassette body forming part of the printing head,

20 Figure 2 is a plan view of the cassette body shown in Figure 1,

Figure 3 is a side view of the said cassette body and shows a cap member thereon,

Figure 4 is a plan view of part of the structure shown in Figure 3,

25 Figure 5 is a perspective view of a serial printer provided with a printing head according to the present invention,

30 Figures 6 and 7 are respectively a plan view and a front view of a part of the structure shown in Figure 5 to illustrate the position of the parts during printing,

Figures 8 to 10 illustrate a second embodiment of a printing head according to the present invention,

Figure 8 is a perspective view of the basic construction of the said second embodiment,

Figure 9 is a side view of the structure shown in Figure 8,

5 Figure 10 is a perspective view of the basic construction of a colour printer incorporating a printer head as shown in Figures 8 and 9,

Figures 11 to 14 illustrate a third embodiment of the present invention,

10 Figure 11 is a perspective view of a printing head according to the present invention,

Figure 12 is a vertical sectional view of the printing head shown in Figure 11, and

15 Figures 13 and 14 are plan views of alternative constructions of sealing members which may be used in the said third embodiment.

In Figures 1-7 there is shown a first embodiment of a cassette type printing head according to the present invention. As shown in Figure 1, within a housing or cassette
20 body 1 of elongated box shape there is housed a liquid ink or a sintered liquid ink material 2, the latter being housed in the hollow interior 1a of the cassette body 1. A hollow cylindrical film supporting member 3, which is formed integrally with the cassette body 1, protrudes from
25 one surface of the cassette body 1. The supporting member 3 is provided on opposite sides thereof with a pair of recessed portions 5, 5 (Figure 2) for guiding a film 4 so that the film 4 can pass through the supporting member 3 at right angles to the length of the cassette body 1a in what will
30 be described as an axial direction. Further, a pair of ink guiding and supplying members 6, 6, which are made of a felt

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or fibrous material, are mounted respectively in two recessed portions 3b, 3b of the inner walls 3a, 3a, of the supporting member 3, the ink supplying members 6 being mounted centrally of the supporting member 3.

5 The end portions of the ink supplying members 6, 6 contact each other. The ink supplying members 6, 6 are provided with curved portions 6a, 6a for easy insertion of the film 4 therebetween. The film 4 can thus both contact and slide with respect to the ink supplying members 6, 6 at
10 contact portions 6b thereof. Thus the ink supplying members 6 are disposed on opposite sides of the film 4, the curved portions 6a guiding the film 4 towards the contact portions 6b. The lower sides of the ink supplying members 6, 6 are immersed in or in contact with the ink 2 in the cassette body
15 1. A valve or bulb member 7, having an O-ring 7a for filling or changing ink, is detachably mounted in an opening 1b in the cassette body 1.

A cap member 8 (Figures 3 and 4) of cylindrical shape, is detachably mounted on the outside of the
20 supporting member 3. The cap member 8 has a pair of slit portions 8a, 8a, on substantially opposite sides of the cap member 8 for guiding the film 4 substantially in the said axial direction. When the cap member 8 is mounted on the supporting member 3, the film 4 is able to slide between the
25 ink guiding members 6, 6 and through the slits 8a, 8a and the recessed portions 5, 5. Drying out of the ink in holes or recesses 4a (Figures 6 and 7) of the film 4 and in the ink supplying members 6, 6 is prevented by the cap member 8.

Recessed portions 11 for detachably mounting the
30 cassette body 1 on a carriage member 9 (Figure 5) are provided at the sides of the cassette body 1. In the embodiment of serial printer illustrated in Figure 5, a pair of cassette bodies 1, 1 are mounted on the carriage member 9

which is movable in the directions indicated by the double headed arrow A. The carriage member 9 is slidably mounted for this purpose on a pair of guide shafts 12, 12 along which they may be moved by a pair of cassette levers 10, 10.

5 A thermal head 13, which is mounted on the carriage member 9, is located between the cassette bodies 1, 1. The supporting members 3, 3 are disposed on opposite sides of thermal head 13 so that ink is supplied to the film 4 from different directions. The thermal head 13 and the cassette bodies 1 are integral

10 with or secured to each other so as to constitute a replaceable cassette for use in a printer.

The film 4, which is guided by and is in contact with the supporting members 3, 3 and with the thermal head 13, has a large number of small holes or recesses 4a as indicated

15 in Figures 6 and 7. Ink 2, which is supplied from the ink supplying members 6, 6, fills each of the small holes or recesses 4a. When a signal current is applied to a heating surface 13a (Figure 6) of the thermal head 13, ink in the small holes or recesses 4a is jetted onto a recording paper sheet

20 15 so as to effect printing on the latter. In this case, a plurality of the small holes or recesses 4a correspond to one dot element of the heating surface 13a. Normally, the heating surface 13a is composed of a plurality of dot elements, the said one dot element corresponding to one picture element.

25 Therefore even if one or two holes or recesses 4a are stopped up, the picture element can still be printed.

The film 4 is entrained around a pair of pulleys 16, 16 and can be extended by means of pins 16a which engage the film 4.

30 In the above described first embodiment of the present invention, the thermal head 13 is disposed between a pair of cassette bodies. However, the same effect can be obtained

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if the thermal head 13 is mounted in a recess formed between cassette bodies constituting an integral structure. Furthermore, it is possible to use a single ink supply member 6 instead of the pair of members 6 described above.

5 In Figures 8-10 there is shown a second embodiment of a printing head according to the present invention.

In the construction shown in Figure 8, a film 4 is made of a thin metallic film of aluminium or an organic film of polyimide and has a large number of holes 4a. The film 4 may be of any desired length and width. Both ends of the film 4 are rolled up so that if a hole or holes 4a become blocked up, a new portion of the film 4 may be brought into use by suitably unrolling the film. A thermal head member 13 has a plurality of thermal head elements 13a and there is an ink supplying member which comprises a cassette body 1 of box like shape which has an ink filling inlet (not shown) so that ink may be introduced into the interior thereof. Ink is supplied to the holes 4a by way of an ink supplying member 6 which is made of sponge material and contacts one surface of the film 4. The thermal head member 13 and ink supplying member 6 are arranged side by side so as collectively to be of cassette shape and to contact a surface of the film 4 and move serially when printing or recording is performed. Ink 2, which is disposed in the holes 4a of the film 1, is jetted onto recording paper 18 by bubble pressure caused by heating the ink in a group of holes 4a by means of a thermal dot element 13a.

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15
20
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Figure 9 illustrates the operation of the film 4 and the thermal head 13. When ink 2 has been introduced into the holes 4a, only the ink 2 in holes 4a aligned with the thermal dot element 13a of the thermal head 13 will be heated.

30

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A flexible cable 17 is used to supply a drive signal to the thermal head 13 from a drive circuit (not shown).

Figure 10 illustrates a basic construction for producing a colour print. The recording paper 18 is mounted on a drum 19.

Alternatively, instead of mounting the paper 18 on the drum 19 as shown in Figure 10, one can use paper of the "one pass" type. Films 4a, 4b, 4c and 4d are employed for the printing of the Y (yellow), M (magenta), C (cyan) and B (black) colours respectively. The thermal head 13 and ink supplying member 6 are used in the manner shown in Figures 8 and 9. A supporting base 20 supports the head 13, the latter being slidably mounted on a pair of supporting bars 21. Colour printing is performed in the line direction by moving the supporting base 20 longitudinally of the drum 19 for each colour. That is to say, in Figure 10 a single thermal head 13 is shown as aligned with the film 4a for printing the colour Y. In practice, however, each of the other films 4b, 4c, 4d would also have its respective thermal head.

The second embodiment of the present invention which is shown in Figures 8-10 makes it possible to effect mono and colour printing by a means of a simple mechanism. Moreover, if the nozzle constituted by a group of holes 4a becomes blocked, all that is necessary is to unroll a fresh length of film 4. Thus the construction is applicable to a copying machine or electronic typewriter.

In Figures 11-14 there is shown a third embodiment of the present invention.

A recording ink cassette or cassette body 1 is employed in a printing head in which a recording ink 2 is housed in a plurality of small holes or recesses 4a of a thin film 4 made of a metal or organic material. The recording ink 2 is jetted towards a recording paper (not shown) by contacting

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the film 4 with a thermal head 13 which causes expansion of the ink in the holes or recesses 4a so as to effect printing by bubble pressure.

5 The recording ink cassette 1 is composed of a recording ink housing member 1b, a recording ink supplying member 6 which is arranged to be connected, as described below, to said housing member 1b so as to supply ink to the holes or recesses 4a, first sealing members 22 for sealing said housing member 1b, and a pressure member 24 having second
10 sealing members 23 which are disposed opposite first sealing members 22. The sealing members 22, 23 engage opposite sides of the film 4 which passes through a space 26 which is sealed by the sealing members 22, 23. The pressure member 24 is pressed by a spring member 25 towards the ink cassette
15 1.

Recording ink 2 fills the sealed space 26 which is sealed by the sealing members 22 and 23 and thus passes into the small holes or recesses 4a of the film 4 which passes through the recording ink 2. The recording ink 2 is supplied to the
20 sealed space 26 by the ink supplying member 6 and, if desired, it may be arranged that the ink supplying member 6 contacts the film 4. The sealing members 22 and 23 prevent the recording ink from leaking out and enable a uniform amount of recording ink to be contained in the small
25 holes or recesses 4a of the film 4. The sealing members 22, 23 may be made of plastics, rubber, a silicone resin or a fluorine resin which has a good low friction characteristic. The sealing members 22, 23 are also preferably O-ring shape.

30 The width of the sealing members 22 and 23 may be greater than the width of the film 4, as shown in Figure 13. However, it is possible to prevent the leakage of the recording ink if the material of the sealing member has a substantial elasticity. Further it is possible to make the width of the sealing

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members 22 and 23 less than the width of the film 4,
as shown in Figure 14.

5 A very thin sealing film 28 is interposed between a
porous or other connecting member 27 which extends between
the reservoir of ink within the housing member 1b and the
recording ink supplying member 6. The sealing film 28 can
easily be broken by pushing a protruding member 29 downwardly
when required, whereby the recording ink 2 is supplied to
the connecting member 27 and thus to the recording ink
supplying member 6.

10 The connecting member 27 is preferably constituted by a
cylindrical member containing a porous or fibrous material.
It is also preferable to use an ink-retaining member made of
porous material, sponge or felt as the recording ink
guiding member 6. The porous or fibrous material operates
15 as an absorbing material to prevent outflow of the ink.
It is also possible to provide a filter (not shown) for filtering
out dust or debris in the ink or a broken piece of the
sealing film 28.

20 In the preferred embodiment of the ink jet printing
system, the film 4 is fixed while the recording ink cassette
1 and thermal head 13 are in sliding contact with the film 4. It is
possible to mount recording ink cassettes 1 on opposite
sides of the thermal head 13 so as to permit a reciprocating
record therebetween.

25 In the constructions described above, ink is constantly
applied to a film, and it is possible to print at a constant
print density without density irregularity by changing
the cassette body when the ink is exhausted or the ink
supplying member is damaged.
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C L A I M S

1. A printing head comprising at least one housing (1) adapted to contain ink (2) and at least one ink supplying member (6) arranged to receive ink (2) from the or a respective housing (1) characterised by at least one film member (4) having a plurality of holes or recesses (4a) therein, the or each film member (4) being arranged to receive ink from the respective ink supplying member or members (6) so that ink (2) is introduced into the said holes or recesses (4a).

5
2. A printing head as claimed in claim 1 characterised in that the or each film member (4) slidably engages the respective ink supplying member (6).

10
3. A printing head as claimed in claim 1 or 2 characterised in that the or a said housing (1) has a film supporting member (3) mounted thereon, the film supporting member (3) having recess portions (5) for guiding the, or the respective, film member (4).

15
4. A printing head as claimed in claim 3 characterised in that a cap member (8) is detachably mounted on the or each film supporting member (3) so as to cover the outer surface thereof, the cap member (8) having a slit portion (8a) for guiding the film member (4).

20
5. A printing head as claimed in any preceding claim characterised in that the or each housing (1) is provided with a pair of ink supplying members (6) which are disposed on opposite sides of the film member (4), each ink supplying member (6) having a curved portion (6a) to guide the film member (4) towards a contact portion (6b) of the ink supplying member (6).

25
6. A printing head as claimed in any preceding claim characterised in that the or each housing (1) is provided with a detachable valve member (7) for introducing ink into the housing (1).

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7. A printing head as claimed in any preceding claim characterised in that the or each housing (1) is provided externally with a mounting recess portion (11) for detachably securing the housing (1) to another member (9).

8. A printing head as claimed in any preceding claim characterised in that the or each housing (1) and the respective ink supplying member or members (6) form part of a replaceable cassette for use in a printer.

9. A printing head as claimed in any preceding claim characterised by at least one thermal head (13) which engages the, or the respective, film member (4) and which is adapted to heat ink (2) in said holes or recesses (4a) so as to cause said ink (2) to be jetted onto a recording medium (15) by bubble pressure.

10. A printing head as claimed in claim 9 characterised in that the thermal head (13) is disposed between two said housings (1).

11. A printing head as claimed in claim 9 or 10 characterised in that the or each thermal head (13) is provided with a plurality of heating dot elements (13a).

12. A printing head as claimed in any of claims 9 to 11 characterised in that the thermal head (13) and the housing or housings (1) are integral with or secured to each other to constitute a replaceable cassette for use in a printer.

13. A printer head as claimed in any of claims 9-12 characterised in that there are a plurality of film members (4a, 4b, 4c, 4d) and respective thermal heads (13) for printing a plurality of different colours.

14. A printing head as claimed in any of claims 1-9 characterised in that the or each film member (4) passes through a sealed space (26) which is supplied with ink by a said ink supplying member (6).

15. A printing head as claimed in claim 14
characterised in that the sealed space (26) is disposed
between the housing (1) and a member (24) which is
resiliently urged towards the housing (1), the sealed
5 space (26) being sealed by sealing members (22,23)
which engage opposite sides of the film member (4).

16. A printing head as claimed in any preceding claim
characterised in that the or each ink supplying member (6) is
connected to an ink reservoir by way of a frangible member
10 (28), means (29) being provided for breaking the frangible
member (28) to enable ink to pass from the ink reservoir
to the ink supplying member (6).

17. A cassette type printing head comprising in
combination; a cassette body for housing ink; an ink
15 guiding member one end of which is immersed in said cassette
body; and a film member having a plurality of holes or
recesses for housing the ink, the film member slidably
contacting said ink guiding member.

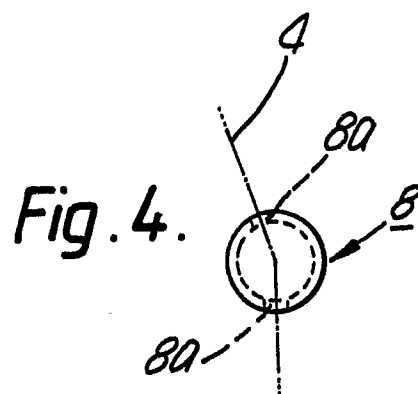
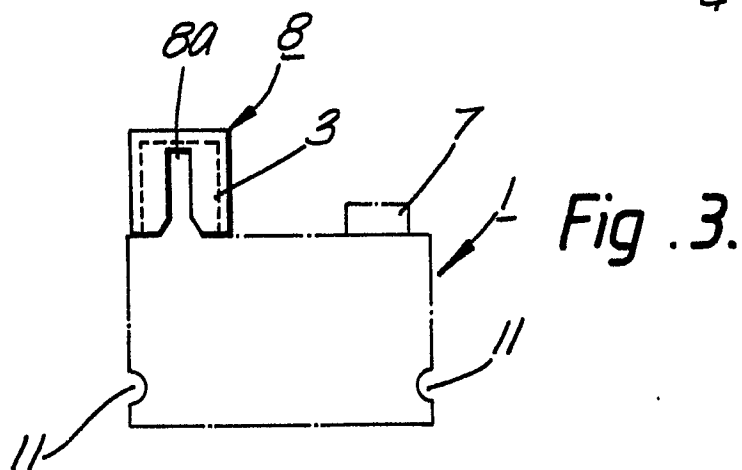
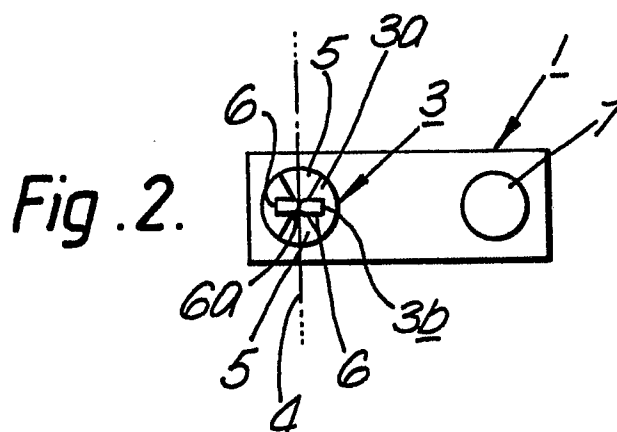
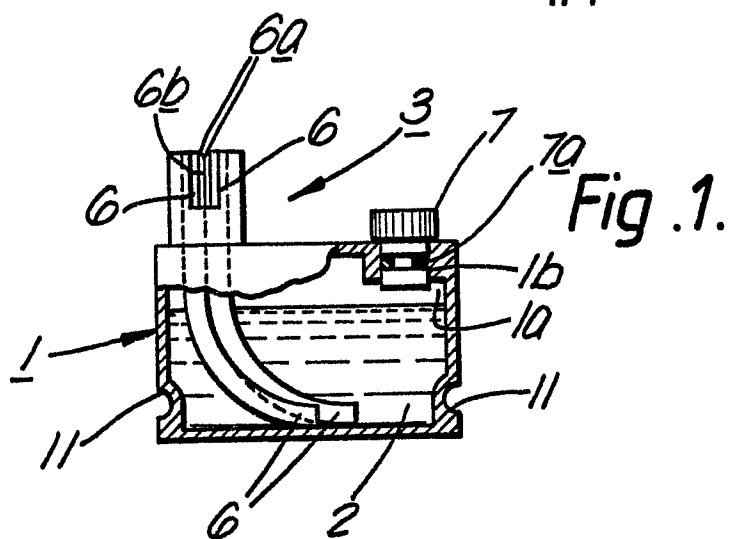


Fig. 5.

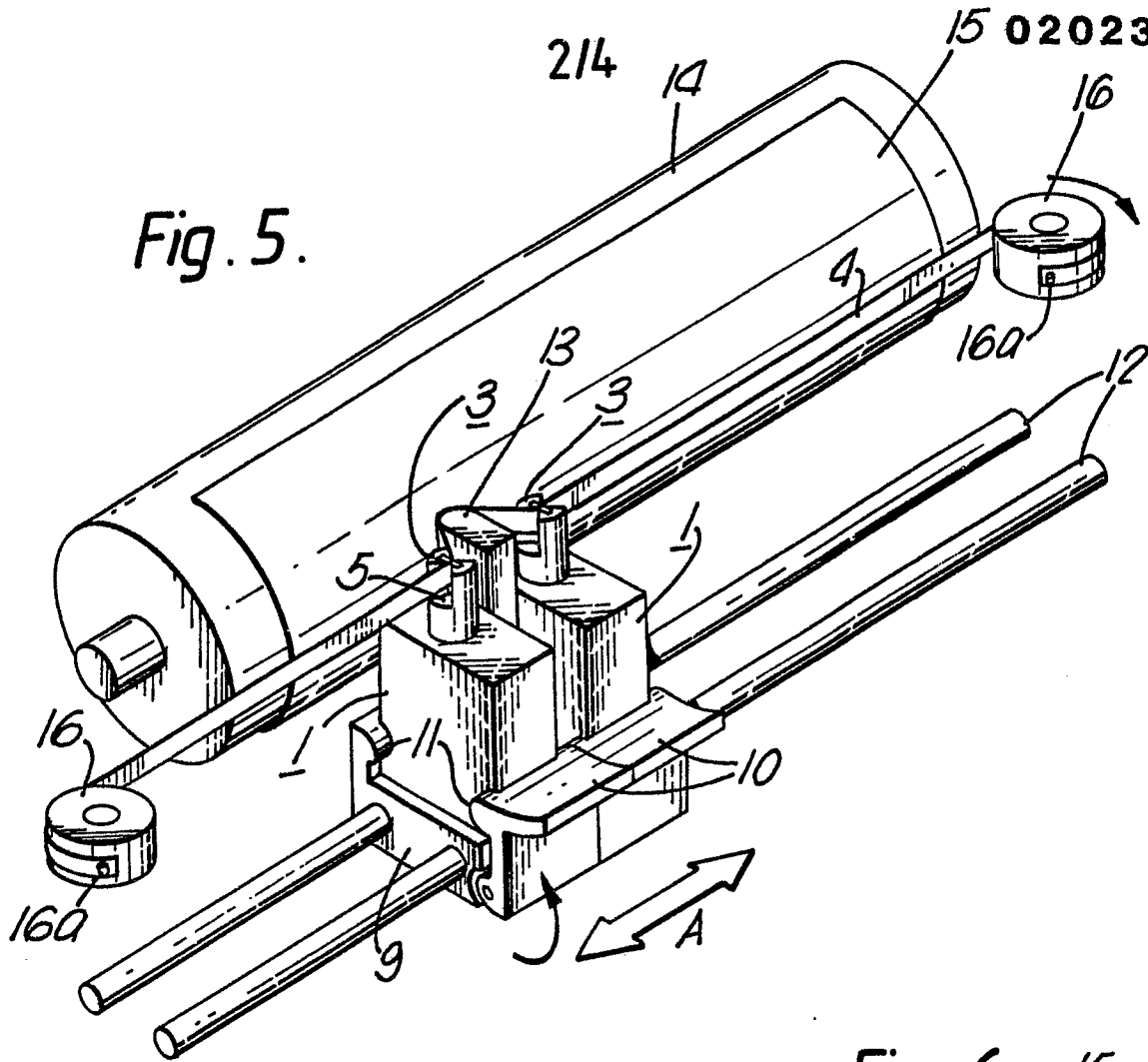


Fig. 6.

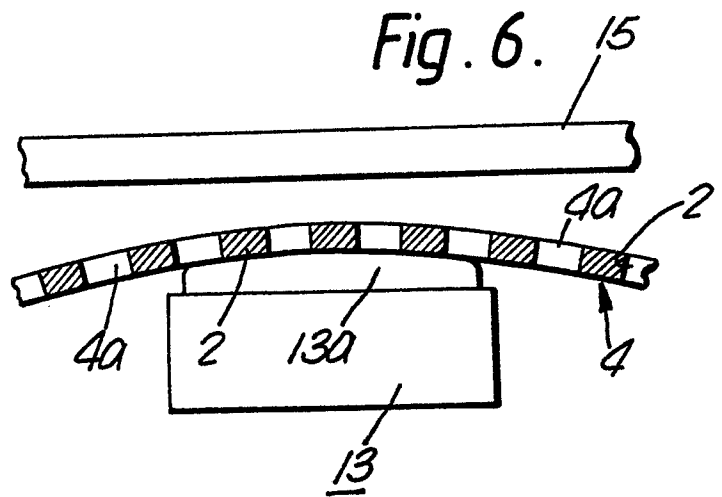
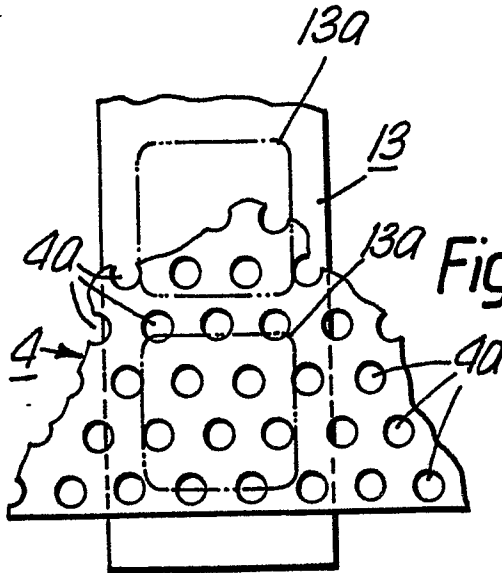


Fig. 7.



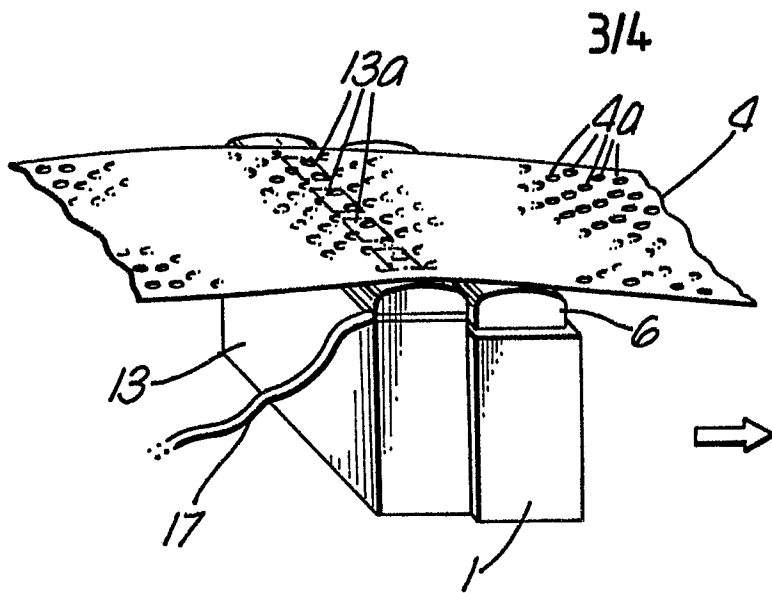


Fig. 8.

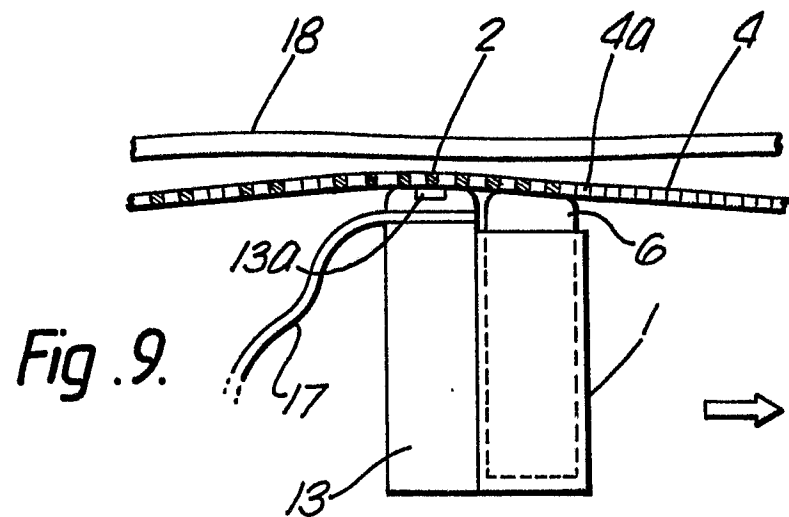


Fig. 9.

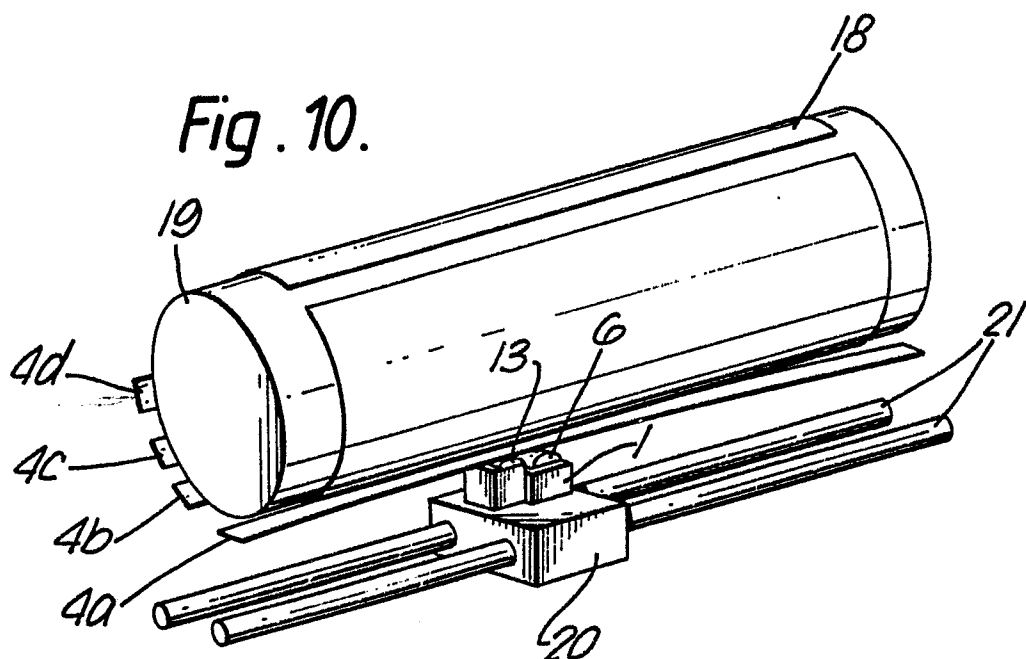


Fig. 10.

Fig. 11.

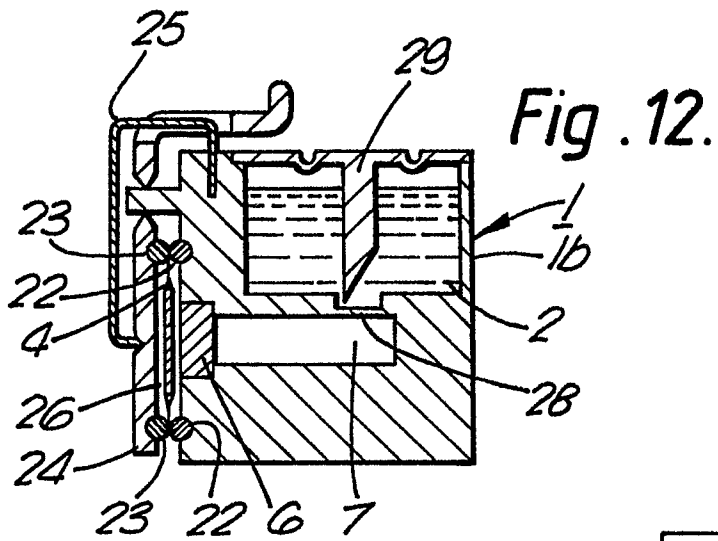
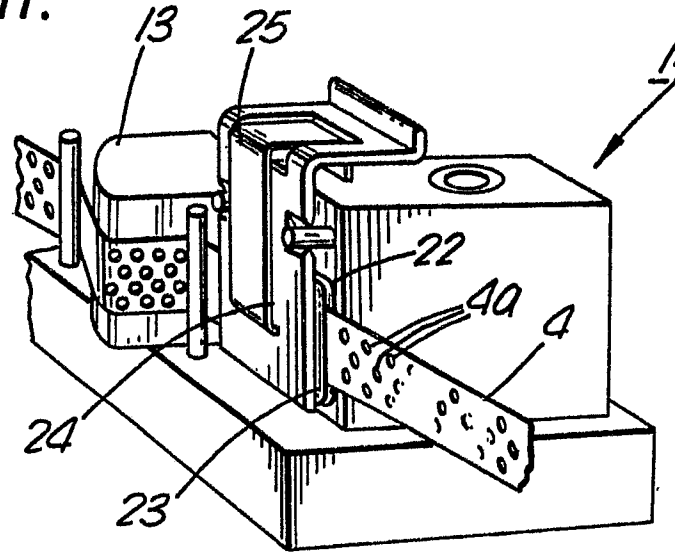


Fig. 13.

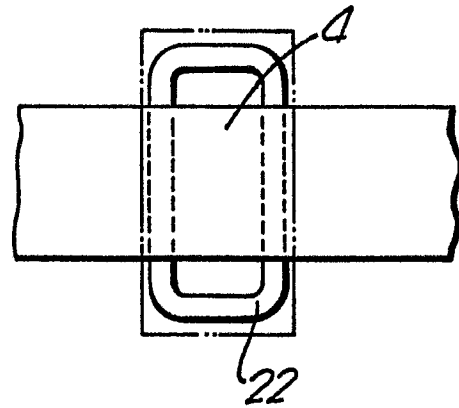
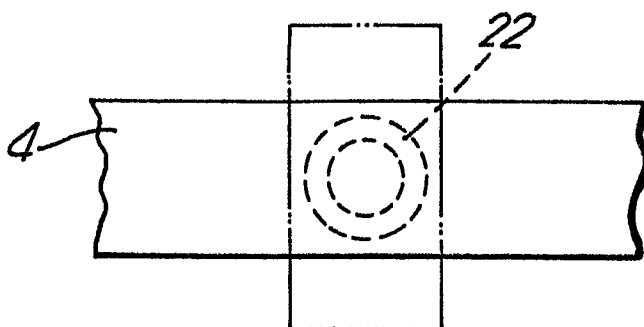


Fig. 14.





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)
Y	PATENTS ABSTRACTS OF JAPAN, vol. 8, no. 270 (M-344) [1707], 11th December 1984; & JP - A - 59 142 158 (ALPS DENKI K.K.) 15-08-1984 * Abstract *	1	B 41 J 3/04 B 41 J 3/22
A	---	2,3	
Y	US-A-4 387 384 (TAKAJI SUE) * Whole document *	1	
A	GB-A-2 142 583 (NIPPON TELEGRAPH & TELEPHONE) * Page 2, line 121 - page 3, line 126; page 5, lines 21-55; figures 7-12 *	9-11, 13	
A	US-A-3 971 040 (S.F. SKALA) * Column 3, lines 1-34; figures 1,2 *	14	TECHNICAL FIELDS SEARCHED (Int. Cl.4) B 41 J
A	IBM TECHNICAL DISCLOSURE BULLETIN, vol. 20, no. 1, June 1977, pages 440-442, Armonk, New York, US; M. RONAY: "Matrix screen printer" -----		
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 14-01-1986	Examiner VAN DEN MEERSCHAUT G
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			