(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 202 370**
A1

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: **85303545.9**

(22) Date of filing: **20.05.85**

(51) Int. Cl.⁴: **B 41 J 3/04**
B 41 J 3/22

(43) Date of publication of application:
26.11.86 Bulletin 86/48

(84) Designated Contracting States:
DE FR GB IT NL

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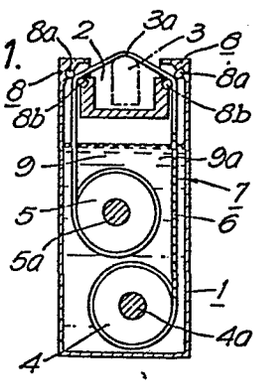
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(54) **Printing head.**

(57) A printing head comprising a casing member (1) having at least one ink reservoir (9*a*) therein, characterised by a thermal head (3) mounted within or adjacent to the casing member (1); a film member (7) having a plurality of holes or recesses (6) therein; and at least one rotatable drive member (4, 5) which drivingly engages the film member (7) and which is rotatable so as to move a portion of the film member (7) from a position in which it is immersed in ink (9) in the or an ink reservoir (9*a*) to a position in which it engages a heating surface (3*a*) of the thermal head (3).

Fig.1.



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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 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, ink is used up in the course of time and 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 supply of ink has not been developed previously.

According to the present invention, there is provided a printing head comprising a casing member having at least one ink reservoir therein characterised by a thermal head mounted within or adjacent to the casing member: a film member having a plurality of holes or recesses therein; and at least one rotatable drive member which drivingly engages the film member and which is rotatable so as to move a portion of the film member from a position in which it is immersed in ink in the or an ink reservoir to a position in which it engages a heating surface of the thermal head.

The thermal head may be mounted in or extend into an open recess in the casing member, film guiding means being provided for guiding the film member to and from the heating surface, the film guiding means being disposed adjacent the open recess and being carried by the casing member.

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The film member may be provided with a plurality of holes or recesses whose diameter does not exceed 250μm.

The film member may be provided with apertured and unapertured portions which alternate with each other longitudinally of the film member, each apertured portion comprising a plurality of the said holes or recesses.

There may be a printing head block comprising a plurality of the said casing members arranged side by side to form an integral unit, each casing member being provided with a respective thermal head and film member, the ink reservoirs of the various casing members being adapted to be filled respectively with differently coloured inks.

In one embodiment of the present invention the film member is an endless film member.

There may be a plurality of the said drive members each of which is driven in the same direction from a drive shaft, an idler which is disposed within the casing member, being interposed between the drive members.

In one embodiment, the thermal head is spaced from the casing member, a portion of the film member passing externally of the casing member through sealing means.

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

Figures 1 to 3 show a first embodiment of a printing head according to the present invention;

Figure 1 is a cross sectional view of a cassette printing head:

Figure 2 is a plan view of one part of a film which forms part of the printing head of Figure 1;

Figure 3 is a cross-sectional view of the cassette printing head of Figure 1;

Figure 4 is a perspective view of a serial colour printer comprising a plurality of printing heads as shown in Figures 1-3;

Figure 5 is a cross sectional view of a second embodiment of a printing head according to the present invention;

Figure 6 is a cross sectional view of a third embodiment of a printing head according to the present invention, this embodiment being suitable for use in a line printer;

Figure 7 is a perspective view of the structure shown in Figure 6;

Figure 8 is a front view of a line colour printer incorporating a plurality of printing heads as shown in Figures 6 and 7;

Figure 9 is an enlarged cross sectional view illustrating the operation of a printing head according to the present invention;

Figures 10 to 13 illustrate a fourth embodiment of a printing head according to the present invention;

Figure 10 is a perspective view of a printer employing a plurality of printing heads according to the present invention:

Figure 11 is a cross-sectional elevation of one of the printing heads of Figure 10;

Figure 12 is a cross sectional side view of the printing head of Figure 11; and

Figures 13A and 13B are respectively a cross sectional side view and a plan view illustrating the operation of the printer of Figure 10.

In Figures 1-3 there is shown a first embodiment of a printing head according to the present invention. As shown in Figure 1, the printing head is of the cassette type and comprises a casing 1, such as a box, which is adapted to be detachably mounted on a main body of a printing machine (not shown). An open recess 2 is provided at the top portion of the casing member 1. A thermal head 3, as shown by a dotted line, is introduced into the open recess 2 when the casing 1 is mounted on the said main body (not shown). The greater part (or, if desired, the whole) of the thermal head 1 is disposed within the recess 2 and thus within the casing 1. The casing 1 has an ink reservoir 9a therein within which are rotatably mounted first and second pulleys 4, 5.

A flexible film member 7 (best shown in Figure 2) has a plurality of holes or recesses 6 whose diameter may be about 10 ~ 200μm. The film member 7 may be made of a metal or organic material, for example flexible polyimide film. The film 7 extends between and drivingly engages the first and second pulleys 4, 5, so that rotation of the latter effects movement of the film member 7. The film member 7 is movably mounted via a pair of film guiding members 8 which are positioned in the neighbourhood of the open recess 2. Each film guiding member 8 is composed of a pair of guide elements 8a and 8b which are made of felt material respectively. This ensures that any unnecessary liquid ink 9, additional to that in the small holes 6, is eliminated. The film guiding members 8 also serve to guide the film member 7 to and from a heating surface 3a of the thermal head 3, the film

guiding members 8 being disposed adjacent the open recess 2 and being carried by the casing member 1.

A plurality of apertured portions or small hole groups 6a, each of which has a large number of small holes 6, are provided in the film member 7 so as to extend over a predetermined distance in the longitudinal direction of the film member 7. Between each pair of adjacent small hole groups 6a there is an unapertured portion 6b, i.e. the small hole groups 6a and unapertured portions 6b are arranged alternately. An unapertured portion 6b may be brought into contact with the heating surface 3a of the thermal head 3 by moving the film member 7 by means of the pulleys 4, 5. One or more small hole groups 6a will then be immersed in the liquid ink 9 in the ink reservoir 9a within the casing member 1 so that drying out of the ink 9 in the small holes 6 is prevented. Further, in another embodiment of the present invention which is not shown in the drawings, the small holes are provided throughout the length of the film member 7, it being possible to use this type of film member 7 by always rotating it by means of the pulleys 4, 5.

Shafts 4a, 5a, which respectively carry the pulleys 4, 5, as shown in Figure 3, protrude into bearing portions 1b of mounting portions 1a which are integrally mounted on one face of the casing member 1. Drive gears 4b, 5b which are drivingly connected to a driving means (not shown) are respectively mounted at the outer ends of the shafts 4a, 5a. Two adjacent O-ring members 10 are positioned between each mounting portion 1a and the respective shafts 4a, 5a to prevent leakage of the ink 9 and to produce a braking effect so as to prevent over running of the shafts 4a, 5a.

Figure 4 shows a colour printing head block 11 which is composed of four cassette casing members 1, of the kind shown in Figures 1-3, for printing a Y colour (Yellow), an M colour (Magenta), a C Colour (Cyan) and a BLK colour (Black), the four casing members 1 being arranged side by side to form an integral unit. Each casing member 1 is thus provided with a respective thermal head 3 and film member 7, the ink reservoir 9a of the various casing members 1 being filled respectively with the said inks. The casing members 1 are arranged to form one integral structure which extends longitudinally of the direction in which the film member 7 is moved. A pair of guide bars 13 are slidably mounted in a pair of guide holes 12 which are provided in the bearing portions 1b of the casing members 1. The colour printing head block 11 is arranged to be reciprocated on the guide bars 13, whereby to provide a cassette type serial colour printing head for a serial colour printing system. When it is desired to change the colour printing head block 11, it is possible to change it by pulling the casing members 1 toward the front whereby the casing members 1 are freed from a lock mechanism (not shown).

Figure 5 shows another embodiment of the present invention in which only one pulley 4 is rotatably mounted in the ink reservoir 9a in the casing member 1. The pulley 4 has a shaft 4a which is rotatably driven by a driving means (not shown). An endless type film member 7a is arranged to slide over the heating surface 3a (which may be provided with thermal dot elements) of the thermal head 3. A part of the film member 7a is engaged and deflected by a tension roller 15. The latter is pivotally mounted on an inner wall of the casing member 1 and is urged towards the film member 7a by a spring member 14. Thus in the embodiment of Figure 5, the small holes (not shown) in the film member 7a are repeatedly used for printing.

Figures 6 and 7 show another embodiment of the present invention constituted by a cassette printing head for a line printing system. In the construction of Figure 6 a casing member 1 has mounted therein a pair of hollow cylinder members 1c, 1d each of which has a length which is almost the same as the width of the paper (not shown) which is to be printed. Each cylinder member 1c, 1d is provided at its opposite end with plate members 1e, 1f which substantially seal the cylinder members 1c, 1d. Liquid ink 9 is housed in an ink reservoir in each of the cylinder members 1c, 1d. Pulleys 4c, 5c are rotatably mounted within these ink reservoirs. A film member 7 which has a plurality of small holes (not shown) therein is mounted on the pulleys 4, 5 so as to be driven thereby, the film member 7 being guided by gaps in guide members 8c, so as to pass into and out of the cylinder members 1c, 1d. One surface of the film member 7 is in contact with the heating surface 3a of the thermal head 3 which is mounted in an open recess in the casing member 1g between the cylinder members 1c, 1d. The pulleys 4c and 5c have shafts 4a, 5a respectively and driving gears 4b, 5b are formed integrally therewith, as shown in Figure 7. The embodiment of Figures 6 and 7 constitutes a one colour line printing cassette head.

The construction shown in Figure 8 is a line colour printing head comprising a line cassette head block 16 having four cassette printing heads for printing Y, M, C and BLK colours, each said printing head having the construction shown in Figures 6 and 7. The cassette printing heads are arranged side by side so as to extend in the same direction as a recording paper 17. The recording paper 17 is slidably moved over the line cassette head block 16 by a belt 20 which has a plurality of suction holes (not shown)

therein, the belt 20 being moved by a pair of pulleys 18, 19. The recording paper 17 is maintained in tight contact with the belt 20 by a vacuum means 21.

Each of the cassette printing heads described above may easily be detachably mounted on a printing machine (not shown), the respective thermal head 3 being mounted in the open recess 2 of the casing member 1 whereby the casing member 1 and thermal head 3 are constructed to be effectively integral with each other. The ink 9 in the small holes 6 of the film member 7, as illustrated in Figure 9, is jetted onto the recording paper 17 by bubble pressure when the heating surface 3a of the thermal head 3 is energised (by means not shown).

Reference will now be made to a further embodiment of the present invention which is illustrated in Figures 10-13.

In Figure 10 there is shown a colour printer comprising a printer head frame 33 which carries four printing heads 32. Each of the printing heads 32 comprises a box-shaped casing member 1h having grooves 1j therein within which are mounted arms 34 by means of which the casing member 1h is carried by the frame 33. Ink 9 is provided in an ink reservoir 9a within each casing member 1h, a pair of pulleys 4d, 5d being rotatably mounted within each ink reservoir 9a. The inks 9 in the ink reservoirs 9a are of the various colours described above.

The end portions of a film 7b which is composed of thin metal, or of a resin material such as polyimide, are connected to the pulleys 4d, 5d. A plurality of small holes or recesses 6, as shown in Figures 12 and 13, are provided in the film 7b, the small holes or recesses 6 being about 10~200μ in diameter and constituting a picture element.

A driving shaft 25 is rotatably mounted in the casing member 1h above the pulleys 4, 5. One end of the driving shaft 25 protrudes outwardly of the casing member 1h and has a gear member 25a. An idler 26 is provided between the driving shaft 25 and the pulley 5d and a further idler 26 is provided between the pulleys 4d, 5d. Thus the driving shaft 25,by way of the idlers 26, drives the pulleys 4d, 5d. The pulleys 4d, 5d and the film 7b are driven in the same direction. However, if desired, it is possible to rotate the pulleys 4d, 5d and drive the film 7b by pressure contact therebetween which does not involve a gear connection.

One end portion of the film 7b extends outwardly of an open portion 27 which is provided at the top of the casing member 1b, the film 7b passing between sealing members 30 and protrusions 29 of a plug 28 so that ink is prevented from escaping from the casing member 1h. An ink filling plug 31 (Figure 12) is detachably mounted at the side of the casing member 1h so that ink may be introduced into the casing member 1h when the ink level drops.

As shown in Figure 10, each printer head 32 is constituted by an ink cassette which is detachably attached to the printer head frame 33. It is thus possible to remove a cassette printer head 32 from the printer head frame 33 by moving the respective supporting arms 34 away from each other and pulling a knob 32a by hand. A plurality of thermal heads 3 are mounted on the printer head frame 33, one for each of the four ink cassettes 32 which may contain inks of the four colours Y, M, C and BLK. An exposed portion 7c of each film 7b, i.e. a portion thereof disposed outwardly of the respective casing member 1h, extends in contact with an outside surface of the respective thermal head 3. Each of the

gear members 25a of the ink cassette printer heads 32 drivingly engages a timing belt 37 of a printer body 35 and is also engaged by a further pulley 28 which is mounted on the printer head frame 33.

The printer head frame 33 is arranged to be reciprocated over a pair of guide bars 39 of the printer body 35. The driving shafts 25 are thus rotated by the timing belt 37, so that a paper 41 on a platen 40 can be printed.

As illustrated in Figure 13, ink in holes or recesses 6 is jetted onto the paper 41 by bubble pressure produced by heating the thermal head 3.

In the embodiments described above, when the ink in a cassette has been used up, it is merely necessary to change the cassette, thereby enabling mono or colour printing.

Further it is possible to effect constant printing by moving the film during the printing operation, whereby any stopping up of the holes or recesses is of little importance.

Furthermore it is possible to print continuously at a constant density.

CLAIMS

1. A printing head comprising a casing member (1) having at least one ink reservoir (9a) therein, characterised by a thermal head (3) mounted within or adjacent to the casing member (1); a film member (7) having a plurality of holes or recesses (6) therein; and at least one rotatable drive member (4,5) which drivingly engages the film member (7) and which is rotatable so as to move a portion of the film member (7) from a position in which it is immersed in ink (9) in the or an ink reservoir (9a) to a position in which it engages a heating surface (3a) of the thermal head (3).

2. A printing head as claimed in claim 1 characterised in that the thermal head (3) is mounted in or extends into an open recess (2) in the casing member (1), film guiding means (8a, 8b) being provided for guiding the film member (7) to and from the heating surface (3a), the film guiding means being disposed adjacent the open recess (2) and being carried by the casing member (1).

3. A printing head as claimed in claim 1 or 2 characterised in that the film member (7) is provided with a plurality of holes or recesses (6) whose diameter does not exceed 250μm.

4. A printing head as claimed in any preceding claim characterised in that the film member (7) is provided with apertured and unapertured portions (6a, 6b) which alternate with each other longitudinally of the film member (7), each apertured portion (6a) comprising a plurality of the said holes or recesses (6).

5. A printing head as claimed in any preceding claim characterised by a printing head block (11) comprising a plurality of the said casing members (1) arranged side by side to form an integral unit, each casing member (1) being provided with a respective thermal head (3) and film member (7), the ink reservoirs (9a) of the various casing members (1) being adapted to be filled respectively with differently coloured inks (9).

6. A printing head as claimed in any preceding claim characterised in that the film member (7a) is an endless film member.

7. A printing head as claimed in any of claims 1-5 characterised in that there are a plurality of the said drive members (4d, 5d) each of which is driven in the same direction from a drive shaft (25), an idler (26), which is disposed within the casing member (1h), being interposed between the drive members (4d, 5d).

8. A printing head as claimed in claim 1 characterised in that the thermal head (3) is spaced from the casing member (1h), a portion of the film member (7b) passing externally of the casing member (1h) through sealing means (28-30).

9. A printing head as claimed in any preceding claim characterised in that the printing head is constituted by a replaceable cassette.

10. A cassette type printing head comprising in combination: at least one pulley member (4,5) which is rotatably positioned in a casing member (1); a film member (7) which is in movable contact with a heating surface of a thermal head (3) and is movably guided by said at least one pulley in said casing member (1); a plurality of small holes (6) in said film member (7); a recording ink (9) which is stored in said casing member (1): said pulley and film members (4,5,7) are immersed in said recording ink (9); said

recording ink (9) is housed in said small holes (6); and said recording ink in said small holes of said film member is moved to a corresponding position on said heating surface of said thermal head (3) by rotating said at least one pulley member (4,5) and consequently moving said film member (7).

Fig.1.

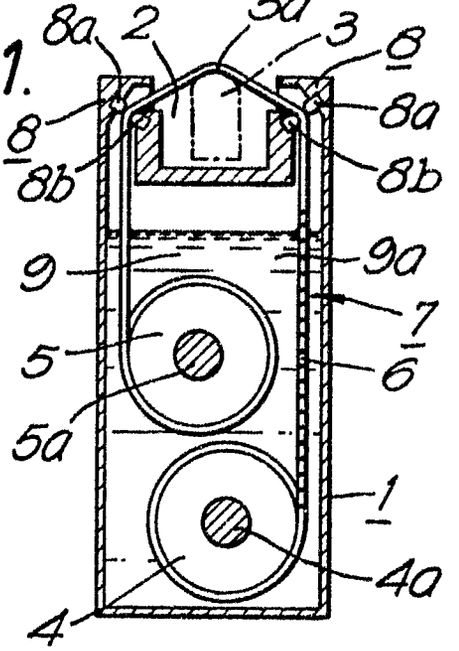


Fig.2.

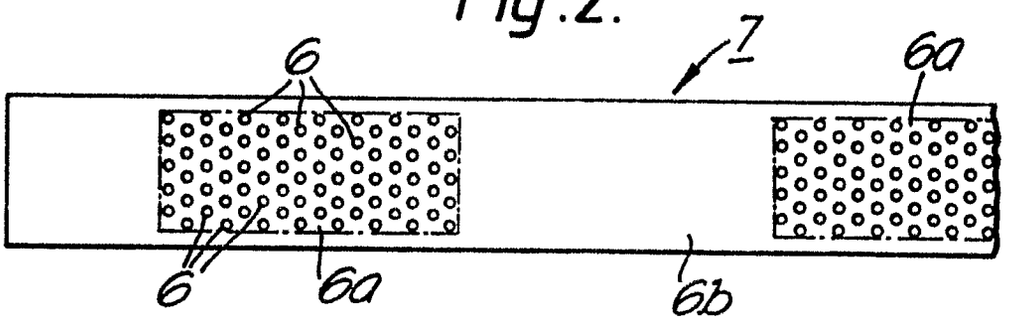


Fig.3.

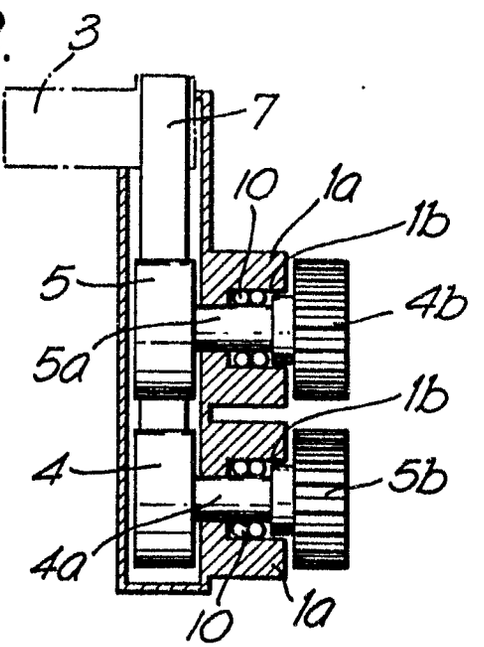


Fig.4.

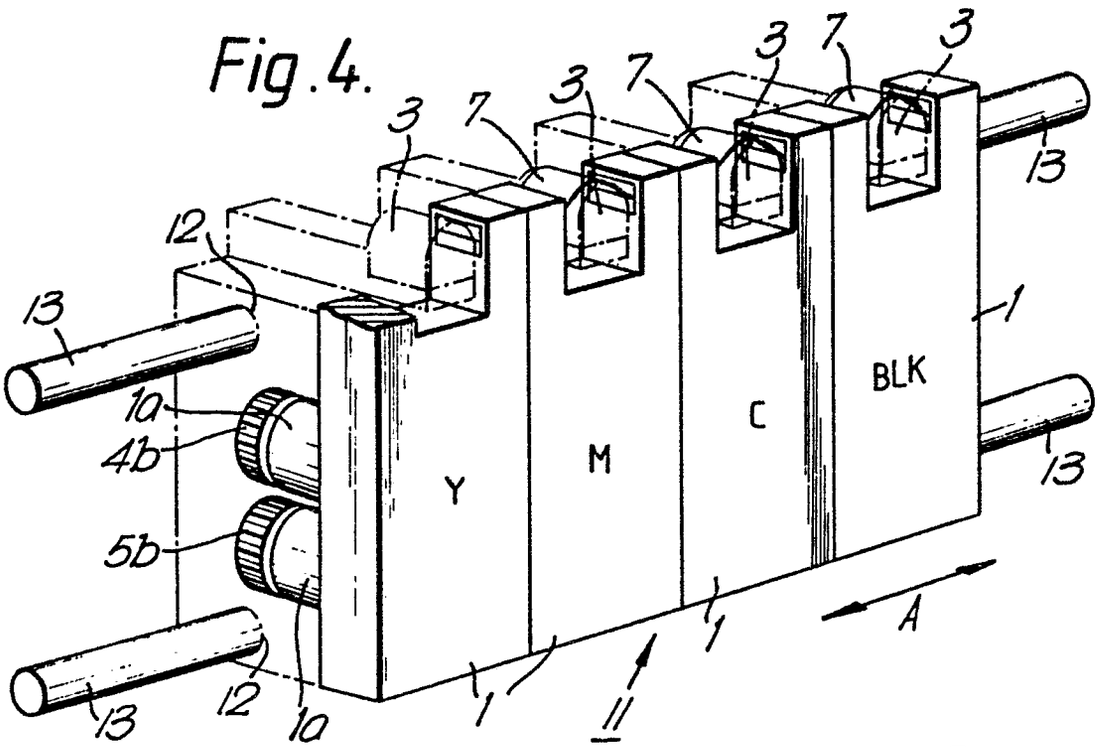


Fig.5.

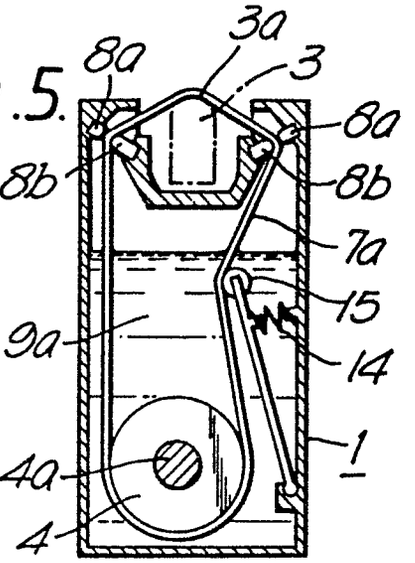


Fig.6.

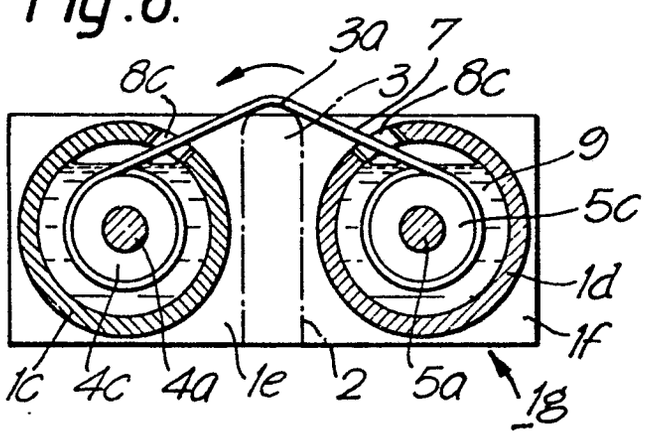


Fig.7.

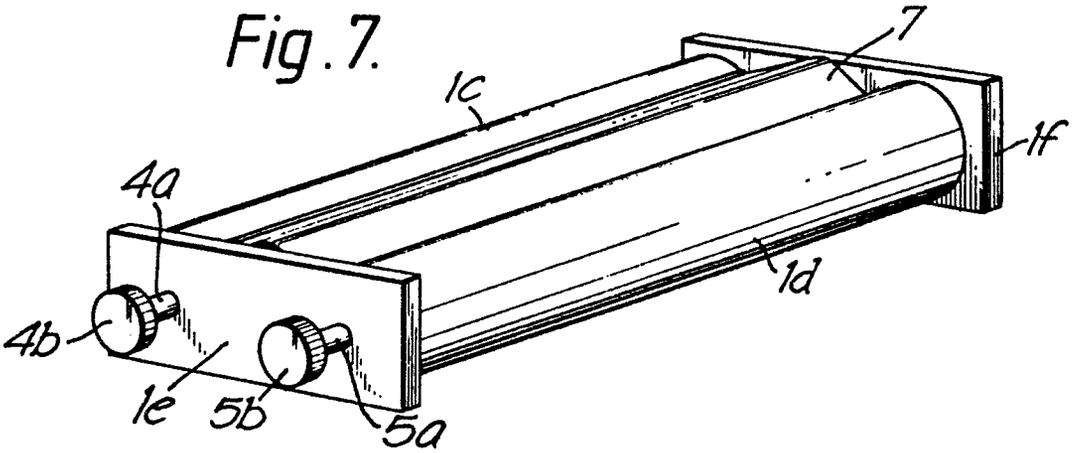


Fig.8.

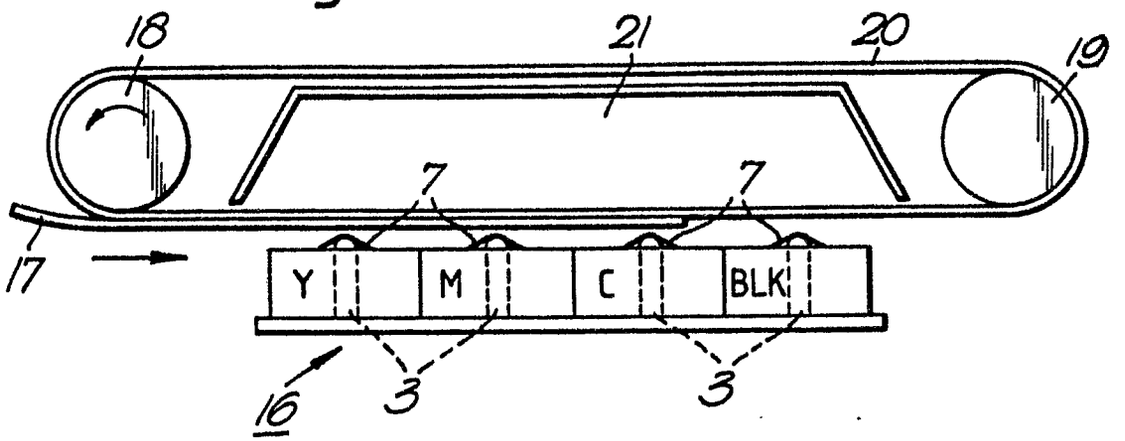


Fig.9.

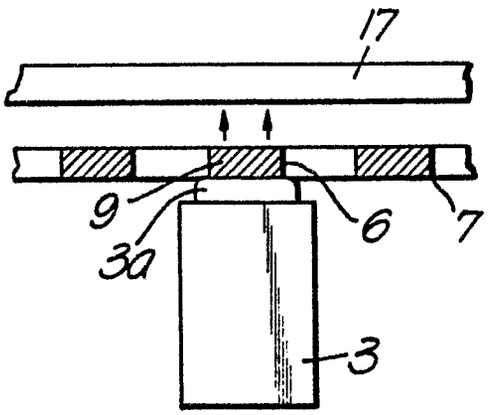
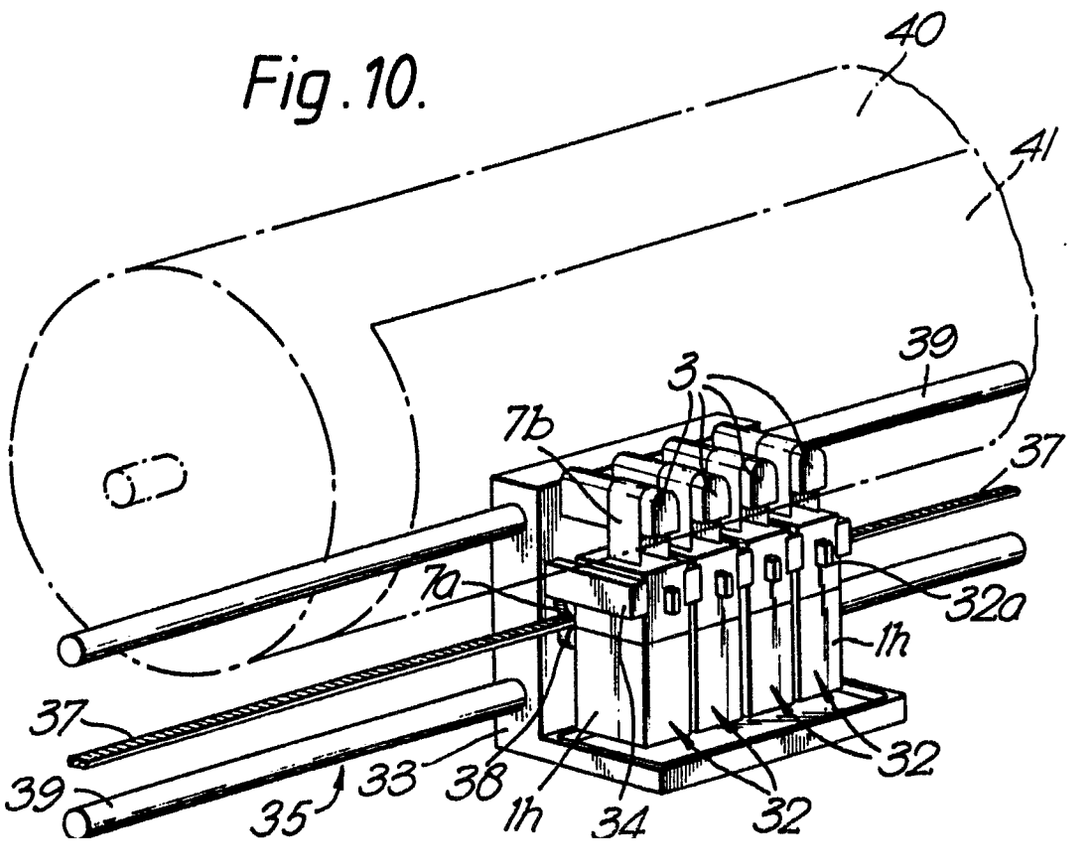


Fig.10.



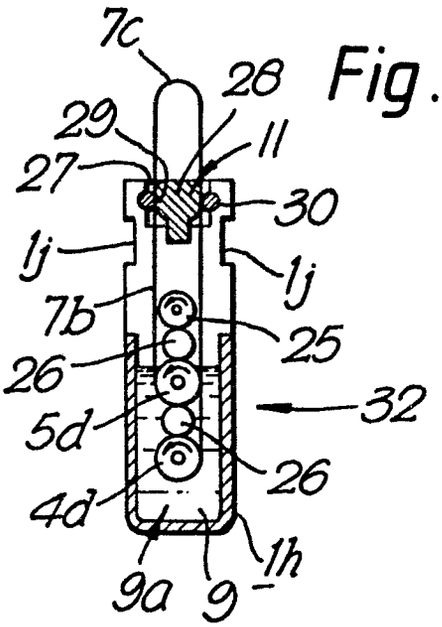


Fig. 11.

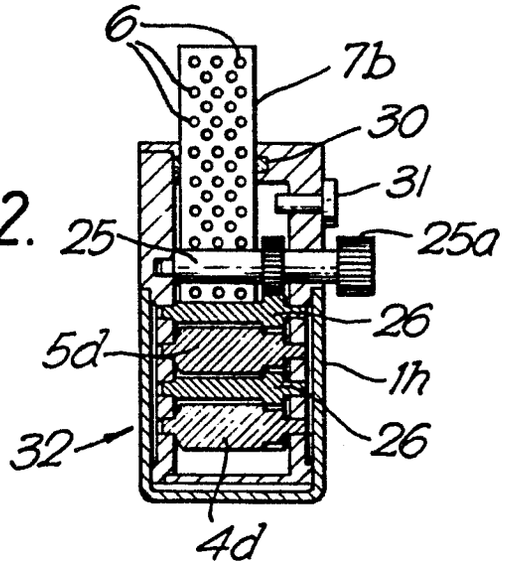


Fig. 12.

Fig. 13A.

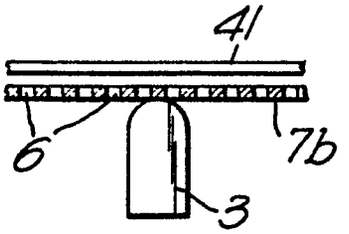
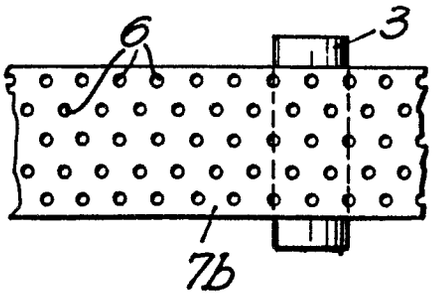


Fig. 13B.



European Patent Office

EUROPEAN SEARCH REPORT

0202370
Application number

EP 85 30 3545

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	US-A-4 387 384 (TAKAJI SUE) * Whole document *	1,10	B 41 J 3/04 B 41 J 3/22
A		2-4,6,7	

Y	GB-A-2 142 583 (NIPPON TELEGRAPH & TELEPHONE) * Page 2, line 121 - page 3, line 126; page 5, lines 21-55 *	1,10	
A	* Figures 7-9,12 *	5	

A	IBM-TECHNICAL DISCLOSURE BULLETIN, vol. 20, no. 1, June 1977, pages 440-442, Armonk, New York, US; M. RONAY: "Matrix screen printer" * Whole document *	1,3	TECHNICAL FIELDS SEARCHED (Int Cl 4) B 41 J

A	EP-A-0 014 918 (SMH-ADREX) * Page 6, line 22 - page 9, line 36; figures 1-10,15,16 *	1	

A	US-A-3 834 301 (J.-P. CROQUELOIS)		

A	US-A-3 640 214 (H.-J. SCHEINHUTTE)		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	14-01-1986	VAN DEN MEERSCHAUT G

CATEGORY OF CITED DOCUMENTS

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