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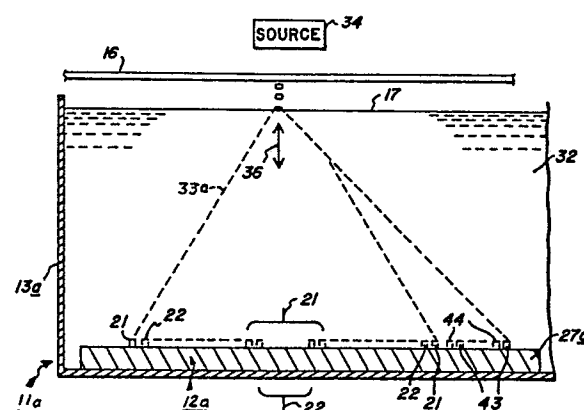
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54 **Leaky Rayleigh wave nozzleless liquid droplet ejectors.**

57 A nozzleless print head for ink jet printing and the like comprises one or more essentially planar surface acoustic wave transducers (12a) which are submerged at a predetermined depth in a liquid filled reservoir (13a) so that each of the transducers (12a) launches a converging cone of leaky, coherent Rayleigh waves into the reservoir, thereby producing an acoustic beam (33a) which comes to a generally circular focus at or near the surface (17) of the reservoir (13a) (i.e., the liquid/air interface). The acoustic beam (33a) may be intensity modulated to control the ejection timing, or an external source (34) may be used to extract droplets from the acoustically excited liquid on the surface (17) of the reservoir (13a) on demand. Regardless of the timing mechanism employed, the size of the ejected droplets is determined by the waist diameter of the focused acoustic beam (33a). To control, the direction in which the droplets are ejected, provision (43, 44) may be made for producing a controllable acoustical asymmetry for steering the focused acoustic beam (33a) in a direction generally parallel to the surface (17) of the reservoir (13a).



**FIG. 4**

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| 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-4 308 547 (K.T. LOVELADY et al.)<br>* abstract; figures 1,2a *<br>---    | 1                                              | B 41 J 3/04                                   |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | US-A-3 211 088 (M. NAIMAN)<br>* figures 1-3 *<br>---                          | 1                                              |                                               |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | DE-A-2 812 372 (IBM CORP.)<br>* figures 2,3 *<br>-----                        | 1                                              |                                               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                               |                                                | TECHNICAL FIELDS<br>SEARCHED (Int. Cl.4)      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                               |                                                | B 41 J 3/04                                   |
| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                               |                                                |                                               |
| Place of search<br>BERLIN                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                               | Date of completion of the search<br>17-05-1988 | Examiner<br>ZOPF K                            |
| <b>CATEGORY OF CITED DOCUMENTS</b><br>X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document<br>T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>.....<br>& : member of the same patent family, corresponding document |                                                                               |                                                |                                               |