

[54] **YOKE MOUNTED JET DROP RECORDING HEAD**

[75] Inventors: **Cyrus T. Brady, Dayton; Peter L. Duffield, Kettering; Phillip H. Houser, Chillicothe, all of Ohio**

[73] Assignee: **The Mead Corporation, Dayton, Ohio**

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[52] U.S. Cl. .... **346/75**  
 [51] Int. Cl. .... **G01d 15/18**  
 [58] Field of Search ..... **346/75, 140**

[56] **References Cited**  
**UNITED STATES PATENTS**  
 3,701,998 10/1972 Mathis ..... 346/75

*Primary Examiner*—Joseph W. Hartary  
*Attorney, Agent, or Firm*—Biebel, French & Bugg

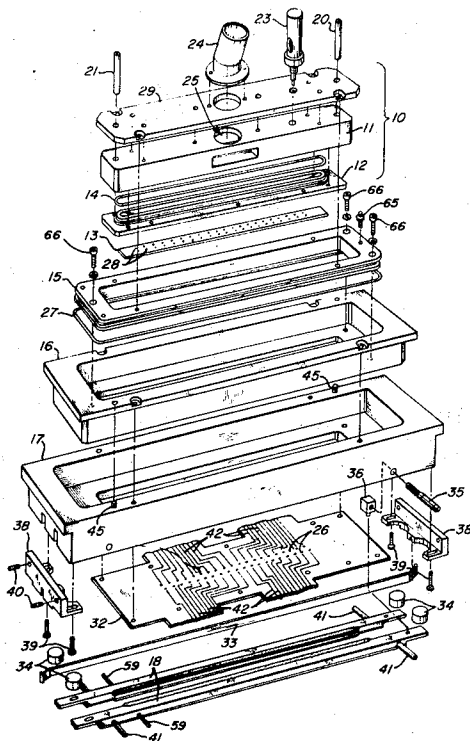
[57] **ABSTRACT**

There is disclosed a recording head for a jet array recorder wherein the electrical components thereof are attached to a supporting yoke and the fluidic components thereof are suspended within the yoke. The pri-

mary fluidic components are separately assembled as a manifold subassembly and suspended inside a wobble plate. The wobble plate in turn is inserted inside an inner yoke, and rides within an "O" ring which provides freedom of movement for vertical adjustment and tilting. Thus the manifold subassembly, which includes an orifice plate provided with one or more rows of jet orifices, may be accurately positioned with respect to the inner yoke. In final assembly the inner yoke is mounted inside the main supporting yoke to which the electrical components have been attached and aligned. A set of dowel pins is provided to insure alignment between the inner yoke and the outer yoke.

There is also disclosed means for supplying a flow of purging air through the recording head and a magnetic catcher mounting arrangement. The purging air is supplied to an air tube fitting which attaches to the manifold subassembly. In the completed assembly the air flows around the outside of the orifice plate and then exits the recording head by flowing outwardly through apertures in a charge ring plate which is fastened to the lower surface of the main yoke. The catchers are mounted below the charge ring plate by attraction to a set of permanent magnets which are set into the lower surface of the main yoke.

**5 Claims, 5 Drawing Figures**



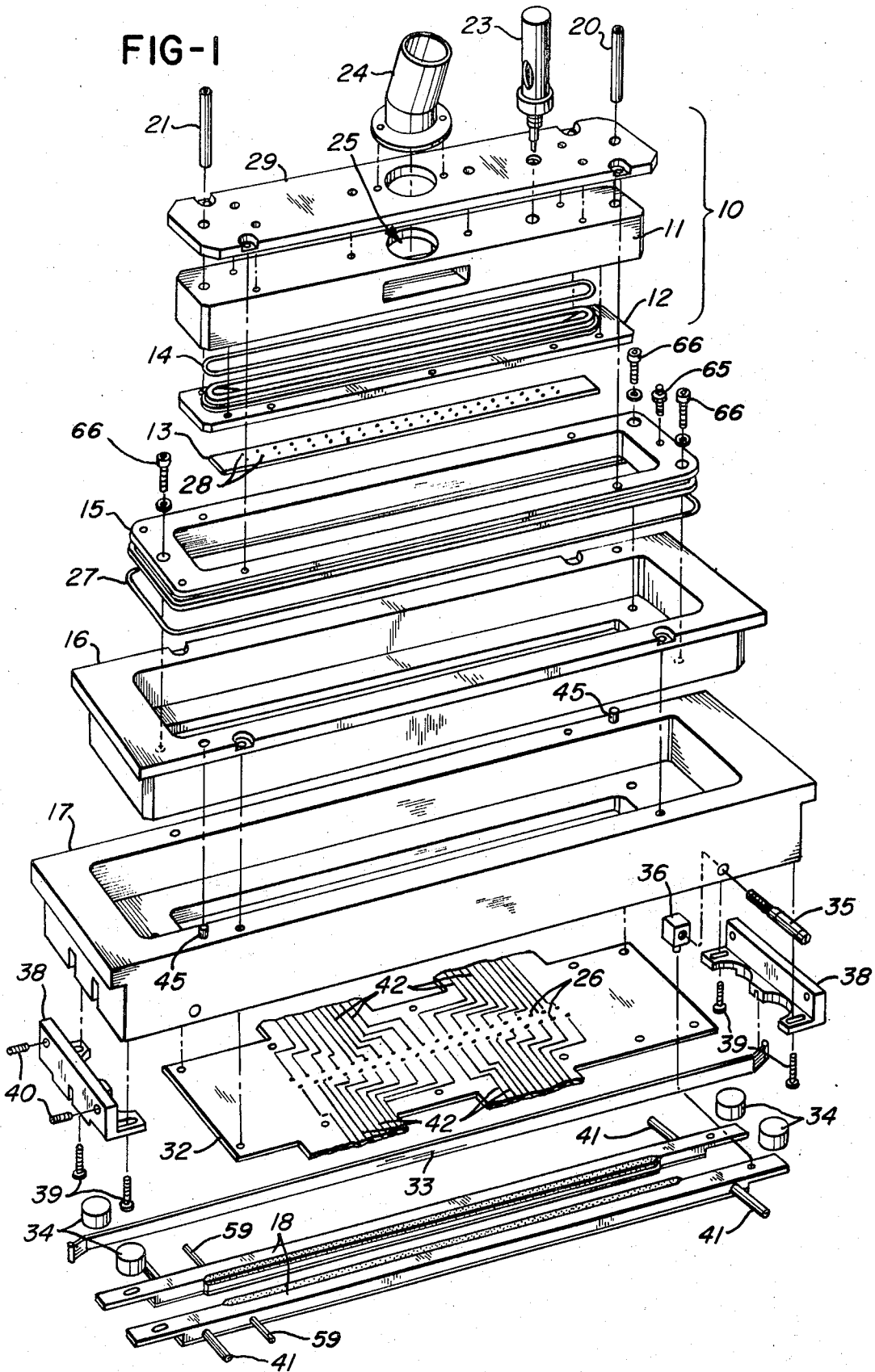




FIG-4

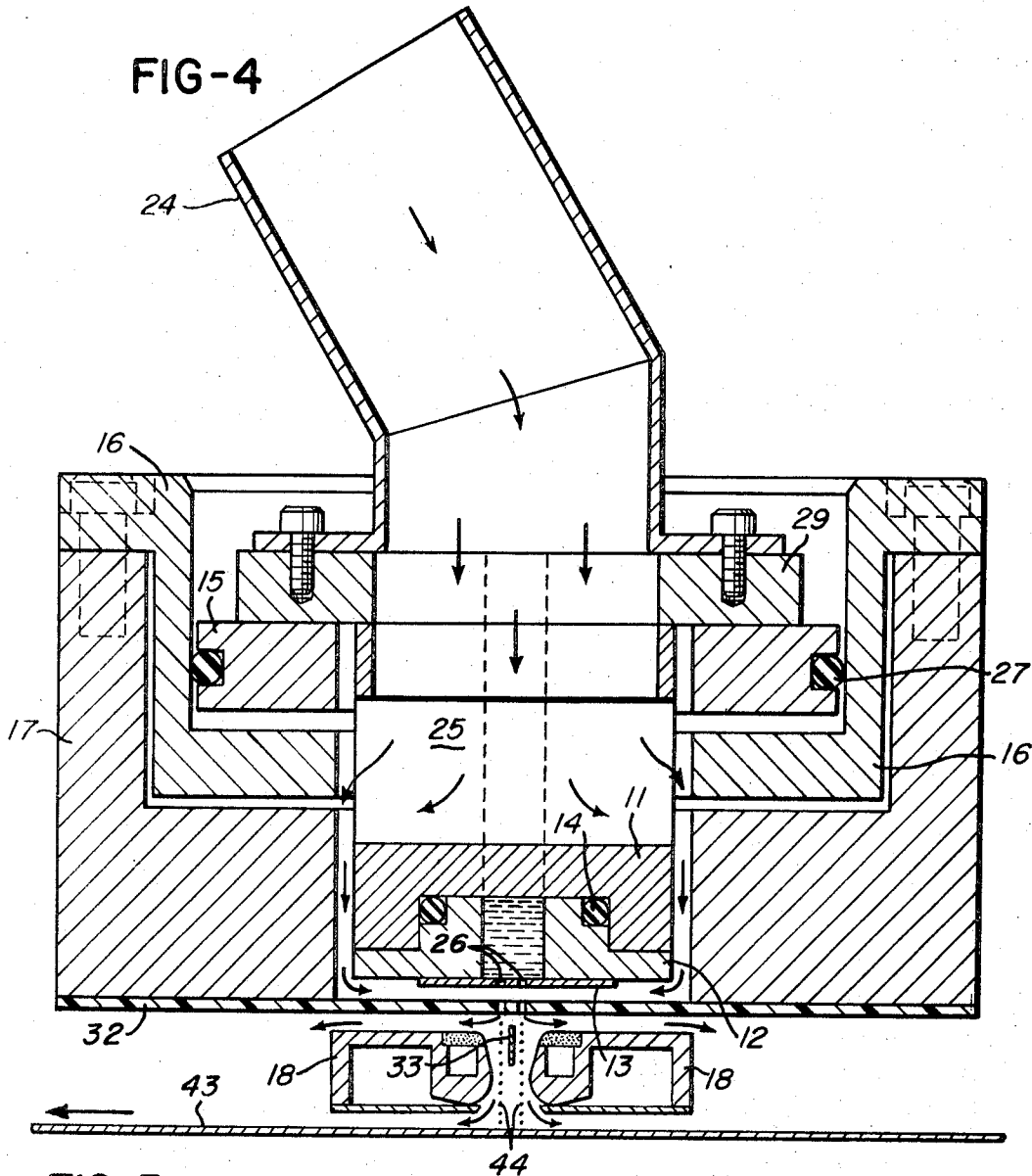
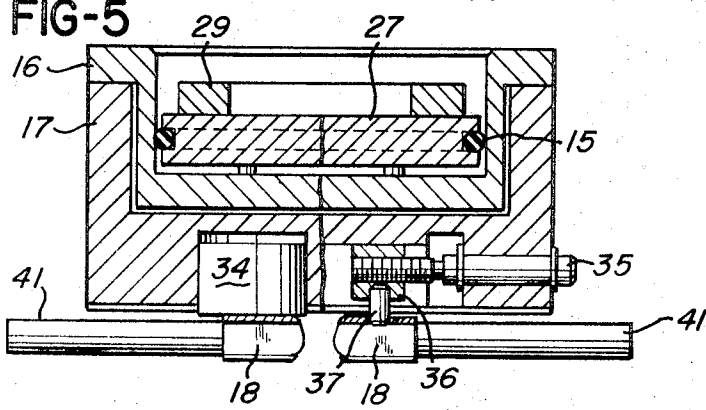


FIG-5



## YOKE MOUNTED JET DROP RECORDING HEAD

### CROSS REFERENCE TO RELATED APPLICATIONS

This application is related to application Ser. No. 317,075 and application Ser. No. 317,073 which were filed on even date herewith and assigned to the assignee hereof.

### BACKGROUND OF THE INVENTION

This invention relates to a recording head for jet drop recording apparatus, and more particularly to a recording head which generates one or more rows of jet drop streams. Typical prior art recording heads are disclosed, for example, in Beam et al U.S. Pat. No. 3,586,907 and Mathis U.S. Pat. No. 3,701,998. In such prior art arrangements the jet streams are created by forcing a printing fluid under pressure through one or more rows of orifices in an orifice plate and stimulating the plate to cause break up of the streams into uniformly sized drops. Further in these prior art recording heads the orifice plate is bonded to a manifold into which the recording fluid is introduced, and other necessary recording head elements are attached to the manifold directly below the orifice plate. Thus the recording head comprises an ink manifold, an orifice plate, a charge ring plate, one or more deflection strips, and one or more catchers, all assembled in a stacked arrangement.

It has been found that such prior art arrangements are inconvenient for assembly and cleaning, and that in normal operation there is a tendency for dust and dirt to enter the assembly from the outside.

### SUMMARY OF THE INVENTION

This invention provides improved means for assembling and handling a recording head for jet array recorder. In particular there is provided a yoke into which the fluid holding manifold is suspended. The orifice plate is attached to the manifold as in the prior art, but other elements of the recording head are attached to the yoke. Thus there is a physical segregation between the electrical and the fluidic elements of the head. Consequently each of these groups of elements may be assembled and checked out independently and brought together in final assembly. This means that if an operating difficulty is experienced because of orifice clogging or the like, the manifold subassembly, which includes the orifice plate, may be removed from the yoke without disturbing the charge plate, deflection ribbon(s), or catcher(s). The yoke may have alignment means thereon so that in the case of the above example, a replacement manifold subassembly may be suspended in the yoke with the original electrical elements still in place.

In a preferred embodiment of the invention there may be employed an inner yoke as well as a main yoke and a wobble plate which fits within the inner yoke. The manifold subassembly is fastened to the wobble plate which is configured for adjusting movement within the inner yoke. There is thus provided considerable freedom of movement for aligning the orifice plate and directing the jets along correct trajectories relative to the charge ring plate. Further, there may be provided an air passage immediately above the charge ring plate and around the manifold subassembly. A connection may be made to this space from the outside for set-

ting up a continuous flow of purging air, and thereby preventing ingestion of any dirt or dust into the printer head.

Accordingly it is an object of this invention to provide improved means for assembling a recording head for a jet array recorder.

Other objects and advantages of the invention will be apparent from the following description, the accompanying drawings and the appended claims.

### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an exploded pictorial view of a jet array printer head employing the invention in a preferred embodiment;

FIG. 2 is an upwardly looking view of a fully assembled printer head;

FIG. 3 is a view taken along lines 3—3 of FIG. 2;

FIG. 4 is a view taken along lines 4—4 of FIG. 2; and

FIG. 5 is a view taken along lines 5—5 of FIG. 2.

### DESCRIPTION OF THE PREFERRED EMBODIMENT

A preferred embodiment of the invention is illustrated in exploded form in FIG. 1 as including a manifold subassembly 10 which fits into a wobble plate 15. Wobble plate 15 fits into an inner yoke 16 which in turn fits within a main yoke 17. There are also provided a charge ring plate 32, a deflection ribbon 33, and a pair of catchers 18, all of which are fastened to the lower surface of main yoke 17 as hereinafter described.

Manifold subassembly 10 comprises a manifold bar 11, a cover plate 29, an orifice plate holder 12, and an orifice plate 13 which fit together as illustrated in FIGS. 1 and 4. Thus orifice plate holder 12 fits upwardly into a cavity in the lower surface of manifold bar 11. Orifice plate holder 12 may be secured in place by screws (not shown) and a fluid tight seal is provided between orifice plate holder 12 and manifold bar 11 by an O-ring 14. Orifice plate 13 is preferably soldered in place against the lower surface of orifice plate holder 12. Manifold subassembly 10 is thus an integral unit which may be assembled and flushed clean prior to any association with any of the electrical components of the recording head.

As further illustrated in FIG. 1, manifold bar 11 and cover plate 29 are provided with internal passages into which may be inserted an ink supply tube 20, an ink return tube 21, a stimulator 23, and an air tube fitting 24. Stimulator 23 has a probe which reaches downwardly for contact with orifice plate 13. Orifice plate 13 is excited to propagate a series of traveling bending waves as described in detail in Lyon et al., Ser. No. 189,297, and stimulator 23 is rotatably adjustable as described in Houser, U.S. Pat. No. 3,701,476. Air tube fitting 24 is used for applying a flow of purging air to the recording head. A flow of air supplied by a fan or other means (not shown) flows downwardly through air tube fitting 24 and thence into an air cavity 25 in manifold bar 11. The purging air then follows a path as generally illustrated in FIG. 4 to exit the recording head through charge ring apertures 26 in charge ring plate 32. This keeps foreign matter out of the charge ring apertures and also provides a stabilizing effect for the liquid jets. The jet stabilizing effect, which forms no part of this in-

vention, is described in Sweet, U.S. Pat. No. 3,596,275.

Once assembled, manifold subassembly 10 is fitted downwardly into wobble plate 15 and fastened thereto as by screws (not shown). Wobble plate 15, with manifold subassembly 10 attached thereto, is fitted downwardly into inner yoke 16 with an O-ring 27 therebetween. It will be appreciated that wobble plate 15 may be adjusted upwardly or downwardly or tilted within inner yoke 16 for adjustment of jet filament lengths to meet requirements as discussed in Ser. No. 189,297. For this purpose there are provided three lifting screws 65 and three hold down screws 66.

Independently of the assembly of manifold subassembly 10, the electrical elements of the recording head may be assembled as a unit by fastening to main yoke 17 as illustrated also in FIG. 1. Charge ring plate 32 is attached directly to the main yoke 17, as are also catchers 18. Charge ring plate 32 is fastened in place by a series of screws, and catchers 18 are secured by means of four cylindrical magnets 34 which are bonded into recesses in the lower surface of main yoke 17. Magnets 34 are common insulated ceramic magnets which are commercially available from many sources. Preferably magnets 34 are made of barium-ferrite ceramic embedded in insulating plastic and are provided with lead-out pole pieces. Catchers 18 are preferably fabricated from a magnetic stainless steel material so that they are firmly grasped by magnets 34.

Lateral adjustment of catchers 18 is provided as best illustrated in FIG. 5 by set screws 35 and adjusting nuts 36. Each adjusting nut 36 is provided with a small downwardly projecting pin 37 which reaches into a mating slot in the upper surface of the associated catcher 18. Set screws 35 reach through openings in yoke 17 for threaded engagement with nuts 36. Thus catchers 18 may be adjusted inwardly or outwardly to provide any desired spacing between the catcher faces and the surfaces of deflection ribbon 33. Catchers 18 are elongated devices as described in detail in copending patent application, Docket 5725. Each catcher is equipped with two vacuum tubes 41 and one vacuum tube 59.

Deflection ribbon 33 is stretched between a pair of tension blocks 38 which in turn are fastened to main yoke 17 as by screws 39. Tension blocks 38 are provided with set screws 40 so that the tension blocks may be adjusted back and forth in the longitudinal direction (see FIG. 2). Set screws 40 are initially adjusted to enable easy insertion of deflection ribbon 33 between tension blocks 38. Thereafter deflection ribbon 33 is drawn to a taut condition.

In operation there are created two rows of drop streams which are selectively charged and caught all as described in detail in Mathis, U.S. Pat. No. 3,701,998. For this purpose charging signals representative of graphic information are applied to terminals 42 of charge ring plate 32. These charging signals cause selective charging of drops 44 (see FIG. 4) which are directed toward a recording medium 43. A static electrical field for the deflection of the charged drops is set up between the deflection ribbon 33 and each of catchers 18. Appropriate deflection fields are set up by attaching deflection ribbon 33 and catchers 18 to sources of different electrical potential. Preferably catchers 18 are grounded, and deflection ribbon 33 is connected to a source of high negative potential. Accordingly the

data system (not shown) applies a positive electrical pulse to one of terminals 42 for each drop or drop packet which is to be caught. These drops, which are negatively charged in response to such pulses, are deflected to impact against the face of one of catchers 18 for ingestion therein. Those drops which are not charged strike recording medium 43 to produce a graphic impression.

It will be appreciated that the alignment tolerances between orifice plate 13 and charge ring plate 32 are quite critical. Accordingly the mounting apertures in charge ring plate 32 and cover plate 29 are oversized to permit minor alignment correcting adjustments. In the usual assembly process manifold subassembly 10 is mounted within wobble plate 15, and thereafter the combined assembly is mounted within inner yoke 16. At this point wobble plate 15 may be adjusted and cover plate 29 may be shifted for precise positioning of orifices 28 relative to inner yoke 16. Then charge ring plate 32 may be mounted on main yoke 17 with charge rings 26 accurately positioned after which inner yoke 16 is fitted into main yoke 17. A pair of precisely positioned dowel pins 45 insure accurate alignment of yoke 16 with yoke 17 and hence accurate positioning of orifices 28 relative to charge rings 26. Alternatively the head may be assembled as above described, but with orifices 28 being directly aligned relative to charge rings 26 as a post assembly procedure. This latter adjustment procedure may be carried out on a trial run basis with a suitable liquid actually filling the recording fluid manifold and forming into jet drop streams. In any event, once the required alignment has been achieved, inner yoke 16 may be removed from main yoke 17 as desired for cleaning or flushing of the fluid components. Then so long as the adjusting screws have not been touched, the head may be reassembled without further aligning adjustment. Thus there is achieved a practical segregation between the fluidic and the electrical components of the recording head.

While the form of apparatus herein described constitutes a preferred embodiment of the invention, it is to be understood that the invention is not limited to this precise form of apparatus, and that changes may be made therein without departing from the scope of the invention.

What is claimed is:

1. A recording head for a jet drop recording apparatus comprising:

a yoke,  
a manifold subassembly comprising a manifold bar and an orifice plate communicating therewith,  
means for removably mounting said subassembly within said yoke, and

a charge ring plate provided with a series of charge rings, said charge ring plate being mounted to an outer surface of said yoke with said charge rings in alignment with corresponding orifices in said orifice plate.

2. Apparatus according to claim 1 said yoke extending around and completely framing said subassembly.

3. Apparatus according to claim 1 said recording head further comprising an elongated catcher magnetically held in place against said outer surface of said yoke.

4. Apparatus according to claim 3 further comprising a second elongated catcher magnetically held in place against said outer surface, and a deflection ribbon mounted to extend between said catchers.

5. Apparatus according to claim 4 further comprising permanent magnets mounted at each end of said yoke for grasping said catchers.

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