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RECORDING WITH GAS

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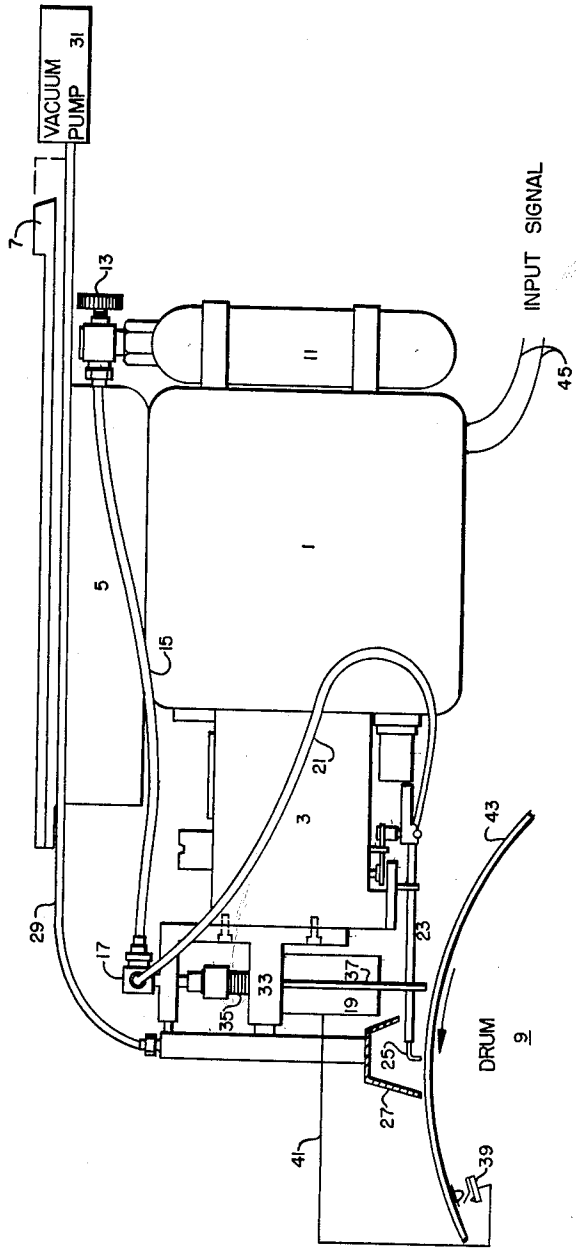

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RECORDING WITH GAS

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The present invention relates to a low torque, dry writing recorder especially suited for recording signals, such as meter readings, seismometer outputs, etc., on a record in immediately visible form.

Various types of recording systems having been developed in an attempt to retain the dry writing properties of pencil-type recorders and yet reduce the high torque required to overcome resistance generated by the recording element contacting the recording paper. Liquid, smoke and air have been used in various ways to reduce writing element torque. However, these systems are not completely satisfactory since they produce wet recording or at least necessitate a bath or some type of process to develop or fix the record to make the recording permanent. When a liquid such as water or ink is used, additional problems of spatter on the record medium and nozzle drip are encountered. Liquids with marking materials such as ink have a tendency to clog the fine opening in the recording nozzle while liquids without marking material require the above-mentioned bath or fixing process to make the record permanent. When smoke or air is used, the record is not permanent unless the recording is followed by some type of fixing operation to prevent the deposited particles from being removed from the record by contact with other objects.

Accordingly, the main object of this invention is to provide a novel recording system that writes dry and yet requires minimum torque to overcome writing resistance.

Another object of this invention is to provide a novel type of recording system that requires no fixing bath or developing operation.

Another object of this invention is to provide a recording system that can be produced by a simple modification of most conventional ink or electrical recorders.

Another object of the invention is to provide a recording system highly suited to producing immediately visible monitor records to check magnetic or photographic recording operations.

Another object of this invention is to provide a dry writing, low torque recorder suitable for making records on transparent film for use in optical correlators, optical computers, etc.

Other objects and advantages of this invention will become apparent from the following description taken in connection with the accompanying drawing.

The preferred form of the instant invention is illustrated in the drawing wherein:

The drawing is a schematic diagram illustrating the principal elements of the present invention.

Briefly described, the invention contemplates the use of ammonia to record a signal on a record containing Ozalid-type photographic emulsion. The ammonia gas stream reacts chemically with the emulsion to produce the recorded signal and ambient light fixes the intelligence permanently on the record by exposing the rest of the film not covered by the ammonia. By utilizing gas and its chemically reactive emulsion minimum torque is required to move the recording means and maximum recording sensitivity is achieved without subjecting the recorder to the problems discussed in the prior art.

Refer now to the drawing showing the preferred embodiment of the recorder. As shown in this figure, the preferred embodiment is a modified Massa rectilinear

recorder Model M–133, although other models can be used. This recorder is well known to those skilled in the art and the unmodified portions include pen motor **1**, compartment **3** containing electrical connections and mechanical linkage, support element **5** and connection **7** adapted to slide into a computer frame or the like. The computer frame maintains the described recording system over drum **9** in a conventional writing attitude. The modified portion of the Massa recorder includes ammonia bottle **11** connected through hand-operated valve **13**, hose **15**, valve **17** operated by solenoid **19**, hose **21** extending through conventional stainless steel recording element **23** and nozzle **25**. An additional modification includes suction bell unit **27** connected through hose **29** to vacuum pump evacuator **31**. Hose **29** should be sufficiently rigid to prevent collapse when subjected to vacuum. Solenoid **19** and suction bell **27** are secured by support frame **33** to compartment **3** as shown. As will be detailed hereinafter, the solenoid is connected in a manner to control the flow of ammonia and raise or lower recording nozzle **25**. The solenoid is connected through spring **35** to needle valve **17** and recording element lift **37**. Microswitch **39** is mounted on drum **9** in a manner so as to be actuated with each rotation of the drum. Solenoid **19** is connected to microswitch **39** by line **41**. Recording drum **9** is shown mounting recording paper **43** covered with Ozalid-type photographic emulsion. The signal to be recorded on **43** is sent to pen motor **1** on input lines **45**.

To prevent the ammonia from corroding the recorder, hose **15**, **21**, **25** and **29** are made of polyethylene or other suitable non-corrosive material. Hose **21** extends through stainless steel recording element **23** and is terminated in a polyethylene recording nozzle **25** with a fine hole diameter of .005 inch. The small diameter nozzle prevents ammonia spatter and excess fumes near the drum. To insure that all fumes are promptly removed from the drum, tubing **29** has a diameter of approximately .125 inch.

Although certain materials, sizes, and connections have been recited above, various substitutions therefor can be made. As an example, other gas can be utilized instead of ammonia provided the gas used chemically reacts with the coating on the record paper to produce a visible mark. If ammonia is used other types of photographic emulsions, such as on Technifax film, may be utilized in place of the Ozalid-type emulsion. If desired, the Technifax can be used to obtain color transparencies for overlay comparison of traces on each transparency.

The hose diameters recited above are preferred; however, other diameters can be used so long as they allow the hose to perform their functions of supply and evacuation. Other types of non-corrosive hose, such as glass, ceramic, Teflon, etc., can be substituted for polyethylene.

The pressure of the gas in source **11** is not critical. As long as there is sufficient pressure to maintain a steady flow of gas through **25** during recording operations, the recorder performs satisfactorily. Of course, it is desirable to store sufficient gas in **11** to have an ample supply available without having to change bottles during recording operations.

Any type of ink or electric recorder can be substituted for the Massa recorder if it can be modified to disperse gas through its writing element as shown in FIGURE 1.

Recording drum **9** can be any conventional record transport; however, if the Ozalid-type recording paper is to be left exposed for any extended period of time, the record transport should use a conventional light box to prevent ambient light from "fixing" the paper. In most cases, however, the paper would not be on the transport long enough to require a light box.

If a plurality of lines are to be recorded simultaneously, a bank of similar recorders shown in FIGURE 1 may be utilized. Although a single large suction bell can be

mounted over the bank of recording pens, the preferred embodiment utilizes an individual suction bell over each recording pen to insure proper evacuation.

Prior to operating the invention, main shut-off valve 13 is opened allowing compressed ammonia in tank 11 to reach needle valve 17. Suction pump 31 is turned on to evacuate any ammonia fumes that may seep from nozzle 25. A sheet of Ozalid paper 43 is mounted on drum 9. To start operations, recording drum 9 is caused to rotate and drum-mounted microswitch 39 is closed actuating solenoid 19. The solenoid compresses spring 35 lowering lift 37 and nozzle 25 and simultaneously opening needle valve 17. A fine stream of ammonia is dispersed through nozzle 25 onto the Ozalid emulsion. The signal to be recorded is sent to pen motor 1 on input lines 45. The movement of recording nozzle 25 is controlled in a conventional manner by the signal actuating the Massa pen motor. After the fine stream of ammonia strikes photographic emulsion 43, suction bell 27 removes the fumes from the area above the drum and exhausts them through hose 29. The portion of emulsion 43 not exposed to the fine line of ammonia is "fixed" by the ambient light during and after the recording of the seismic signal.

From the description above, variations and modifications of the invention obvious to one skilled in the art may be made without departing from the scope of this invention which is limited only by the appended claims.

I claim:

1. An improved dry writing recording system responsive to electrical signals comprising

(*a*) a source of gaseous ammonia,

(*b*) a first conduction means connected to said source,

(*c*) a flow control valve attached to said first conduction means,

(*d*) a second conduction means which is flexible and connects to said control valve,

(*e*) a movable recording element attached to said second conduction means,

(*f*) lift means associated with said recording element,

(*g*) a recording nozzle rigidly joined to said recording element,

(*h*) a recording medium sensitive to said ammonia,

(*i*) a rotatable drum supporting said recording medium,

(*j*) a microswitch which is actuated each time said drum revolves,

(*k*) a solenoid electrically connected to said microswitch for controlling flow through said control valve and adjusting the position of said recording element relative to said recording medium by actuating said lift means,

(*l*) a pen motor electrically connected to said recording element for moving same in accordance with input electrical signals,

(*m*) exhaust means including a hood positioned over said recording nozzle, and

(*n*) a vacuum source attached to said exhaust means for removing excess ammonia vapors.

2. The recording system of claim 1 wherein the solenoid simultaneously acts

(*a*) to open the flow control valve allowing ammonia to pass, and

(*b*) to actuate the lift means in order to move the recording nozzle toward the recording medium until proper recording position is attained.

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