

Description

The present invention relates to an image recording method and apparatus which jets dye vapor produced by the vaporization of sublimable dye to a surface of a recording medium for forming thereon characters and patterns.

There have so far been proposed various methods which use sublimable dyes for picture image recording, a few of which will be exemplified below.

First, there is a method disclosed in Japanese Patent Publication No. 56—2020, which is as shown in Figs. 5 and 6. Referring to one example as shown in Fig. 5, there are provided a nozzle 2 including therein sublimable dye 1, a recording member 3, a charging electrode 4 disposed therebetween, an electrostatic lens system 5, and electrostatic deflecting electrodes 6, wherein dye vapor 8 is generated by heating the dye by a heater 7 provided within the nozzle 2 and the dye vapor 8 is charged with electricity by the charging electrode 4. While the charged dye vapor 8 flies toward a back plate 9 dispersed in the back of the recording member 3, the flying dye vapor 8 is converged by the electrostatic lens system 6 and deflected by the electrostatic deflecting electrodes 6 and attached to the surface of the recording member 3.

And, the other example as shown in Fig. 6 is provided with an electrostatic shutter 10 instead of the electrostatic deflecting electrodes 6 in the structure of Fig. 5, and the jet amount of the dye vapor 8 to the recording member 3 is controlled by the electrostatic shutter 10.

As systems using a plurality of such fundamental arrangements of recording method as described above to achieve color recording, there are such as disclosed in Japanese Patent Laid-open Nos. 54—71636 and 54—71637.

According to these systems, the dye vapor 8 is continuously jetted from the nozzle 2. And therefore, there has been such a problem that the recording member 3 is stained by the dye vapor 8 jetted during a non-printing period whereby the picture image is degraded.

A second method in the prior art is that which is described in Japanese Patent Laid-open No. 59—22759 as shown in Fig. 7. According to this method, in front of a nozzle 11 are radially arranged three-color sublimable-dye sticks 12 on a plane perpendicular to the axis of the nozzle, and there are also provided a laser beam source 13 and an air system 14. A lens system 15 is driven such that the laser beam from the laser beam source 13 is condensed and irradiated on a desired sublimable dye stick 12 out of the three colors of the sublimable dye sticks 12 to produce vapor of that dye. The dye vapor is jetted from the tip of the nozzle 11 by action of compressed air sent from the air system 14 and attached to the surface of a recording member 16.

In this last method, the flow of the compressed air blown out from the nozzle 11 impinges on the recording member 16 and diverted thereby from

its course and spread around the nozzle 11 along the recording member 16. Since the dye vapor transported by the compressed air is thus spread to a rather wide range compared with the diameter of the nozzle 11, it has been a difficulty of this method that the recording member 16 is thereby attained and quality of the picture image deteriorated.

Thus compositely the prior art provides an image recording apparatus comprising a dye chamber adapted to contain a sublimable dye, a heating device to heat said dye, a nozzle adapted to jet a dye vapor therefrom toward a recording member, and a jet control device responsive to a picture signal to control said jet.

A first object of the invention is to provide a image record of good quality.

A second object of the invention is to provide an apparatus which will achieve the above mentioned object in a simple procedure.

Accordingly the present invention is characterized by a gas stream generating device adapted to generate a gas stream transverse to the jet of gas vapor flowing from the nozzle.

The present invention thus generates a gas stream passing across the dye vapor stream jetted from the nozzle, whereby the surface of the recording member is prevented from being stained, and image recording of good printing quality is attained.

The invention will now be described, by way of illustration only, with reference to the accompanying drawings, wherein:

Fig. 1 is a side view in vertical cross-section showing a first embodiment of the invention;

Fig. 2 is a perspective view of the same;

Fig. 3 is a side view in vertical cross-section showing a second embodiment of the invention;

Fig. 4 is a perspective view of the same; and

Figs. 5 and 7 are side views in vertical cross-section showing examples of the prior art.

A first preferred embodiment of the invention will be described below with reference to Figs. 1 and 2. To begin with, a recording head 18 is provided opposite to a recording member 17. Within the recording head 18 is formed a dye chamber 19, in which is contained a sublimable dye 20 is inside the dye chamber 19. On the side face of the recording head 18, there is provided a dye supply portion 21 wherefrom the sublimable dye 20 is adapted to be supplied to the dye chamber 19. Under the dye chamber 19 is provided a heater 22 serving as a heating device and the sublimable dye 20 heated by the heater 22 is formed into dye vapor 23 to fill up the dye chamber 19.

On one side of the dye chamber 19, there are provided a plurality of nozzles 24 opening towards the recording member 17 and arranged at predetermined spacings in a straight line. Each nozzle 24 is provided at the tip thereof with a spray amount control device 25. A shutter by means of electrostriction resonator, magnetostriction resonator, or the like is employed as the spray amount control device 25. These spray

amount control devices 25 are connected with a picture signal source 26, and the amounts of the dye vapor 23 jetted from the nozzle 24 are adapted to be controlled by a picture signal from the picture signal source 26.

Further, an air pump 27 as a gas stream generating device is provided. This air pump 27 is connected with the dye chamber 19 by an air passage 28 and produces an air stream 29 to build up the internal pressure within the dye chamber 19. An air passage 30 is also drawn from the air pump 27 and the end of the air passage 30, formed into an air outlet 31, is opened close to the nozzle 24. The air stream blown out from the air outlet 31 forms an air stream 32 passing across the space between the nozzle 24 and the recording member 17. The velocity of the air stream 32 is to be regulated so as not to disturb the dye vapor stream 33 jetted from the nozzle 24 and therefore set to one fifth the velocity of the dye vapor stream 33.

In the described structure, the air whose pressure is boosted by the air pump 27 builds up the internal air pressure within the dye chamber 19 and, on the other hand, passes through the air passage 30 and is blown out from the air outlet 31 to be formed into the air stream 32. Under these conditions, the spray amount control device 25 is actuated by a signal from the picture signal source 26 and a specific nozzle 24 is thereby opened to produce the dye vapor stream 33. The dye vapor stream 33, without being disturbed by the air stream from the air outlet 31, allows the dye vapor 23 to contact with, and attach to, the surface of the recording member 17, whereby a dot as a picture element is formed thereon. At this time, however, not all portion of the dye vapor 23 jetted from the nozzle 24 is attached to the recording member 17, but some portion thereof remains floating, or suspended, close to the surface of the recording member 17. The floating dye vapor 23, or fine particles formed from the sublimable dye which has already cooled down are taken away from the surface of the recording member 17 by the air stream 32 coming from the air outlet 31. Thus, the recording member 17 is prevented from being stained by the surplus dye vapor 23 in picture image forming and fine particles formed from the cooled sublimable dye, and therefore the quality of the picture image is maintained in good condition.

In the above described embodiment, the surplus dye vapor 23 in picture image forming or the fine particles formed from the cooled sublimable dye are taken away by means of an air stream, but in implementation any suitable gas may be employed.

Now, a second preferred embodiment of the invention will be described with reference to Figs. 3 and 4, wherein like or corresponding parts to those in the above described first embodiment are denoted by like reference numerals and description thereof are omitted. The present embodiment is arranged such that an air suction opening 34 is disposed opposite to the air outlet

31 with the nozzle 24 located therebetween. The air suction opening 34 is connected to an air passage 36 with a filter 35 provided therein and further connected to a suction pump 37, whereby a gas suction device 38 is formed.

In the described structure, the air stream 32 passing across the dye vapor stream 33 jetted from the nozzle 24 is sucked in by the suction pump 37 through the air suction opening 34. And the dye vapor which has not attached to the recording member 17 or the fine particles of the sublimable dye formed by being cooled are recovered by the filter 35. Therefore, the apparatus is prevented from being contaminated by the dye vapor or the fine particles of the sublimable dye formed by being cooled.

Claims

1. An image recording method comprising the steps of heating a sublimable dye (20) to produce a dye vapor (23),

jetting the dye vapor from a nozzle (24) toward a recording member (17) to attach the dye vapor to the recording member to form a picture image thereon;

characterized in that a gas stream (32) is provided transverse to the jet of said dye vapor at a flow velocity such that the dye vapor stream is not adversely affected.

2. An image recording method according to claim 1 characterized in that the gas stream (32) has a pressure which is about 1/5th of the pressure applied to the dye vapor (23).

3. An image recording method according to either preceding claim characterized by positioning a vacuum port (34) downstream of said gas stream port (31) and said nozzle (24) to remove surface dye vapor from adjacent the recording member (17).

4. An image recording apparatus comprising a dye chamber (18) adapted to contain a sublimable dye (20),

a heating device (22) to heat said dye, a nozzle (24) adapted to jet a dye vapor (23) therefrom toward a recording member (17),

a jet control device (25) responsive to a picture signal (26) to control said jet;

characterized by a gas stream generating device (27) adapted to generate a gas stream (32) transverse to the jet of gas vapor flowing from said nozzle (24).

5. An image recording apparatus according to claim 4 characterized by a plurality of nozzles (24) disposed in alignment, and in that an air outlet (31) with a long and narrow opening is provided alongside the alignment of the nozzles (24).

6. An image recording apparatus according to either of claims 4 or 5 and characterized by a vacuum port (34) downstream of said gas stream port (31) and said nozzle(s) (24) to remove surplus dye vapor from adjacent the recording member (17).

7. An image recording apparatus according to any of claims 4 to 5 characterized in that the gas

stream generating device (27) is also in operative interconnection (29) with the dye chamber (18) to increase the pressure therein to a value significantly in excess of the pressure applied to the air stream (32).

Patentansprüche

1. Bildaufzeichnungsverfahren, enthaltend die Schritte des Erwärms einer sublimierbaren Farbe (20) zur Erzeugung eines Farbdampfes (23), das Aufsprühen de Farbdampfes aus einer Düse (24) gegen einen Aufzeichnungsträger (17), um den Farbdampf auf dem Aufzeichnungsträger anzubringen, um einen Bildabdruck darauf auszubilden;

dadurch gekennzeichnet, daß ein Gasstrom (32) quer zu dem Farbdampfstrahl mit einer solchen Strömungsgeschwindigkeit vorgesehen ist, daß der Farbdampfstrahl nicht nachteilig beeinflußt wird.

2. Bildaufzeichnungsverfahren nach Anspruch 1, dadurch gekennzeichnet, daß der Gasstrom (32) einen Druck hat, der etwa 1/5 des Druckes ist, der dem Farbdampf (23) zugeführt wird.

3. Bildaufzeichnungsverfahren nach einem der vorhergehenden Ansprüche, gekennzeichnet durch das Positionieren einer Unterdrucköffnung (34) stromabwärts der Gasstromöffnung (31) und der Düse (24), um Oberflächenfarbdampf aus der Nachbarschaft des Aufzeichnungsträgers (17) zu entfernen.

4. Bildaufzeichnungsvorrichtung, enthaltend eine Farbkammer (18), die dazu eingerichtet ist, einen sublimierbaren Farbstoff (20) aufzunehmen,

eine Heizvorrichtung (22) um Erwärmen des Farbstoffs,

eine Düse (24), die dazu eingerichtet ist, einen Farbstoffdampf (23) daraus gegen einen Aufzeichnungsträger (17) zu sprühen,

eine Sprühsteuervorrichtung (25), die auf ein Bildsignal (26) zur Steuerung des Strahls anspricht, gekennzeichnet durch eine Gasstromerzeugungsvorrichtung (27), die dazu eingerichtet ist, einen Gasstrom (32) quer zu dem Gasdampfstrahl zu erzeugen, de aus der Düse (24) ausströmt.

5. Bildaufzeichnungsvorrichtung nach Anspruch 4, gekennzeichnet durch mehrere Düsen (24), die in Ausrichtung angeordnet sind, und daß ein Luftauslaß (31) mit einer Langen und schmalen Öffnung Längs der Ausrichtung der Düsen (24) angeordnet ist.

6. Bildaufzeichnungsvorrichtung nach einem der Ansprüche 4 oder 5, gekennzeichnet durch eine Unterdrucköffnung (34) stromabwärts der Gasstromöffnung (31) und der Düse(n) (24), um überschüssigen Farbstoffdampf aus der Nachbarschaft des Aufzeichnungsträgers (17) zu entfernen.

7. Bildaufzeichnungsvorrichtung nach einem der Ansprüche 4 bis 6, dadurch gekennzeichnet, daß die Gasstromerzeugungsvorrichtung (27) auch in wirksamer Verbindung (29) mit der Farbstoffkammer (18) ist, um den Druck darin auf

einen Wert zu steigern, der wesentlich über dem Druck liegt, der dem Luftstrom (32) zugeführt wird.

5 Revendications

1. Un procédé d'enregistrement d'image comprenant les opérations consistant à chauffer une teinture sublimable (20) pour produire une vapeur de teinture (23),

à émettre en jet la vapeur de teinture depuis une buse (24) vers un élément d'enregistrement (17) pour fixer la vapeur de teinture sur l'élément d'enregistrement afin de former sur celui-ci une image vidéo,

caractérisé en ce qu'un flux de gaz (32) est créé transversalement audit jet de ladite vapeur de teinture à une vitesse d'écoulement telle que le flux de vapeur de teinture n'est pas affecté de manière contraire.

2. Un procédé d'enregistrement d'image selon la revendication 1, caractérisé en ce que le flux de gaz (32) est à une pression qui est d'environ 1/5^{ième} de la pression appliquée à la vapeur de teinture (23).

3. Un procédé d'enregistrement d'image selon l'une quelconque des revendications précédentes, caractérisé par le positionnement d'un orifice d'aspiration (34) en aval dudit orifice de flux de gaz (31) et de ladite buse (24) pour éliminer la vapeur de teinture de surface du voisinage de l'élément d'enregistrement (17).

4. Un dispositif d'enregistrement d'image comprenant une chambre de teinture (18) prévue pour contenir une teinture sublimable (20),

un dispositif de chauffage (22) pour chauffer ladite teinture,

une buse (24) prévue pour émettre en jet une vapeur de teinture (23) à partir de celle-ci vers un élément d'enregistrement (17),

un dispositif de commande de jet (25) sensible à un signal d'image (26) pour commander ledit jet,

caractérisé par un dispositif de génération de flux de gaz (27) prévu pour produire un flux de gaz (32) transversal au jet de vapeur de gaz s'écoulant à partir de ladite buse (24).

5. Un dispositif d'enregistrement d'image selon la revendication 4, caractérisé par plusieurs buses (24) disposées en alignement, et en ce qu'un orifice de sortie d'air (31) comportant une ouverture longue et étroite est prévu le long de l'alignement des buses (24).

6. Un dispositif d'enregistrement d'image selon l'une quelconque des revendications 4 ou 5, et caractérisé par un orifice d'aspiration (34) en aval dudit orifice de flux de gaz (31) et de ladite ou lesdites buses (24) pour éliminer la vapeur de teinture en surplus du voisinage de l'élément d'enregistrement (17).

7. Un appareil d'enregistrement d'image selon l'une quelconque des revendications 4 à 6, caractérisé en ce que le dispositif de génération de flux de gaz (27) est également en interconnexion fonctionnelle (29) avec la chambre de

teinture (18) pour augmenter la pression à l'intérieur de celle-ci jusqu'à une valeur significative-

ment en excès de la pression appliquée au flux d'air (32).

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FIG. 1

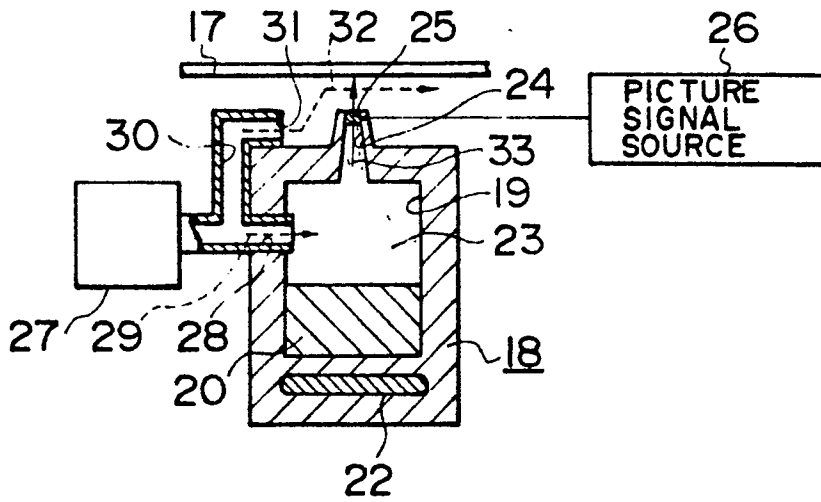


FIG. 2

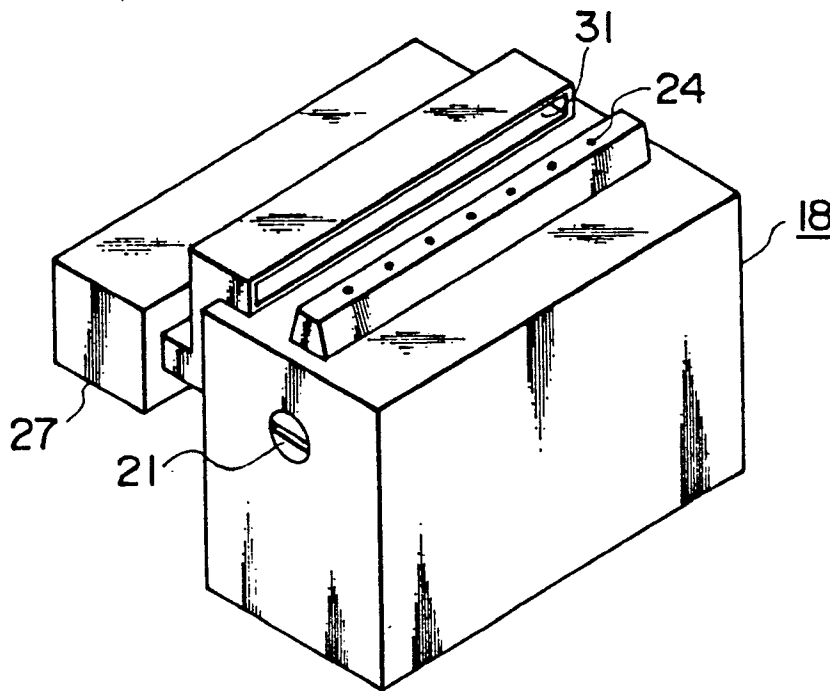


FIG. 3

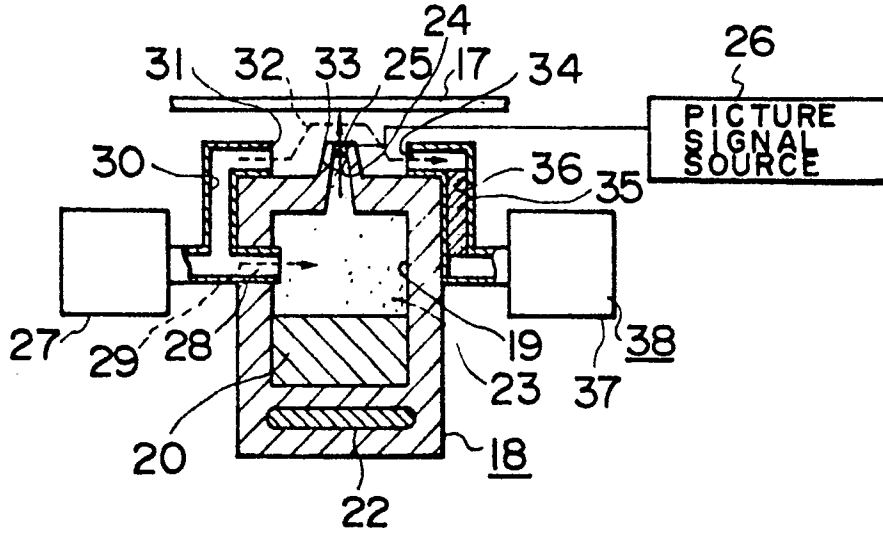


FIG. 4

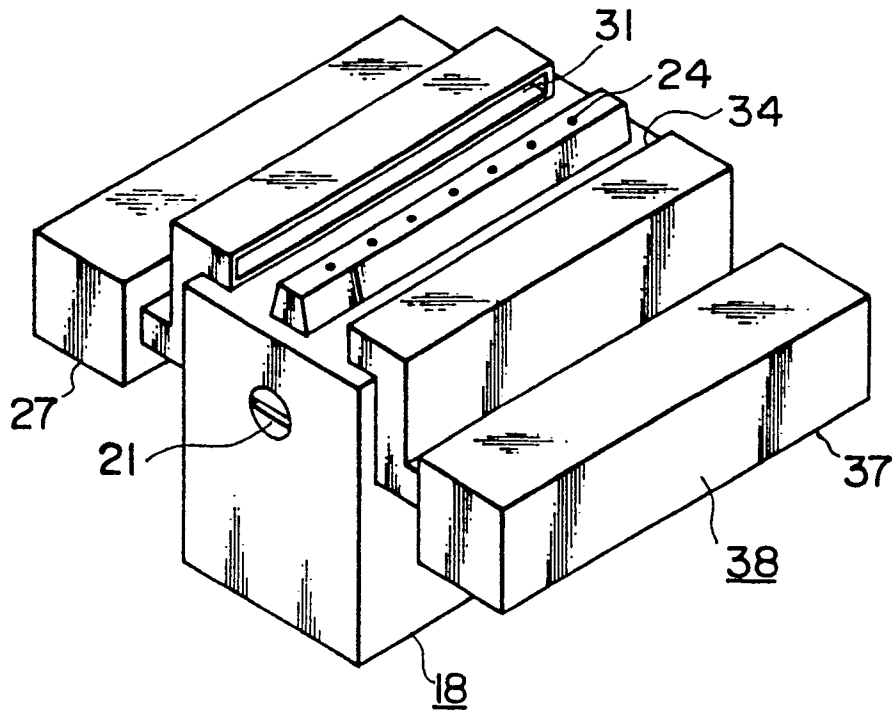


FIG. 5

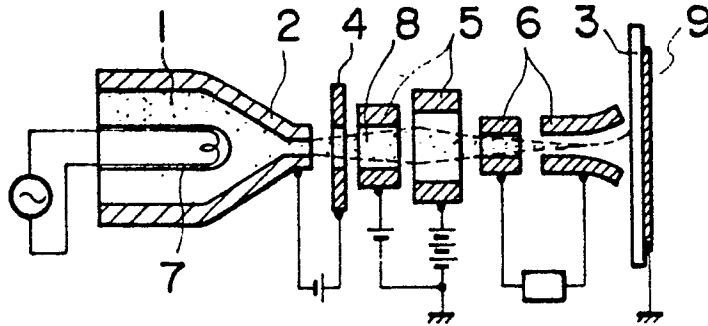


FIG. 6

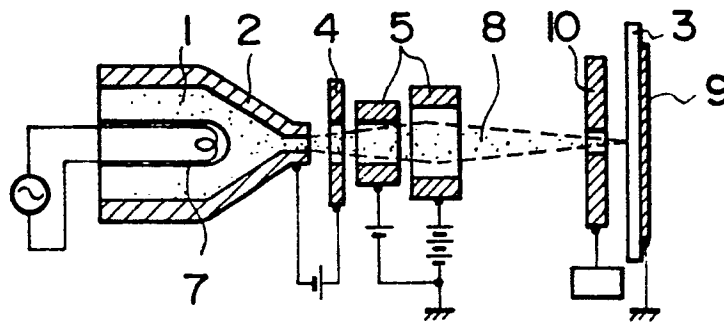


FIG. 7

