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Gibbons et al.

[11] **3,836,987**

[45] **Sept. 17, 1974**

[54] **PHOTOGRAPHIC CHEMICAL WASTE HANDLING APPARATUS AND METHOD**

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[73] Assignee: **Eastman Kodak Company,** Rochester, N.Y.

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[52] **U.S. Cl.** **354/300,** 55/70

[51] **Int. Cl.** **G03d 7/00**

[58] **Field of Search** ..... 95/89 R, 89 G, 94 G; 55/70, 95, 244; 354/297, 300, 324

[56] **References Cited**

UNITED STATES PATENTS

1,980,469	11/1934	Breton	95/89 G
3,323,436	6/1967	Hafer et al.	95/89 G
3,679,369	7/1972	Hashimoto et al.	95/89 G X

FOREIGN PATENTS OR APPLICATIONS

1,480,476	4/1967	France	95/89 G

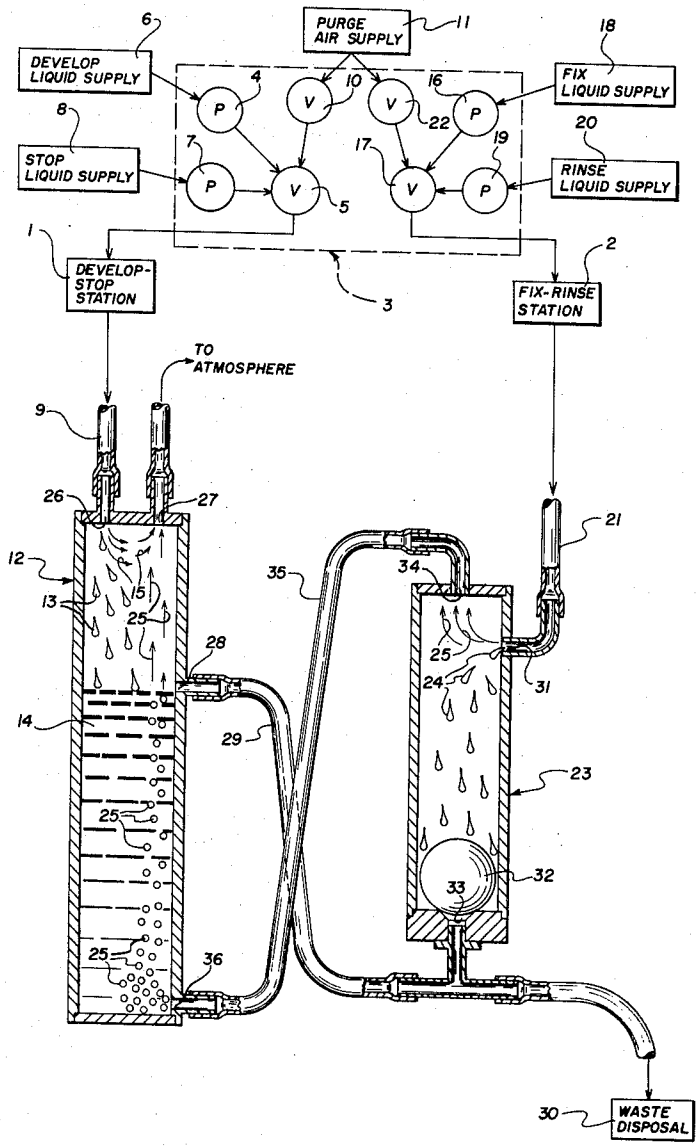
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[57] **ABSTRACT**

A waste gas and a waste liquid, containing chemicals which have been used in the processing of film, are brought into contact with each other in a waste holding chamber. During such contact, the waste liquid serves to substantially completely remove a noxious substance from the waste gas. Thereafter, the waste gas is vented from the chamber into the atmosphere without the polluting affect that the noxious substance might otherwise produce.

8 Claims, 2 Drawing Figures



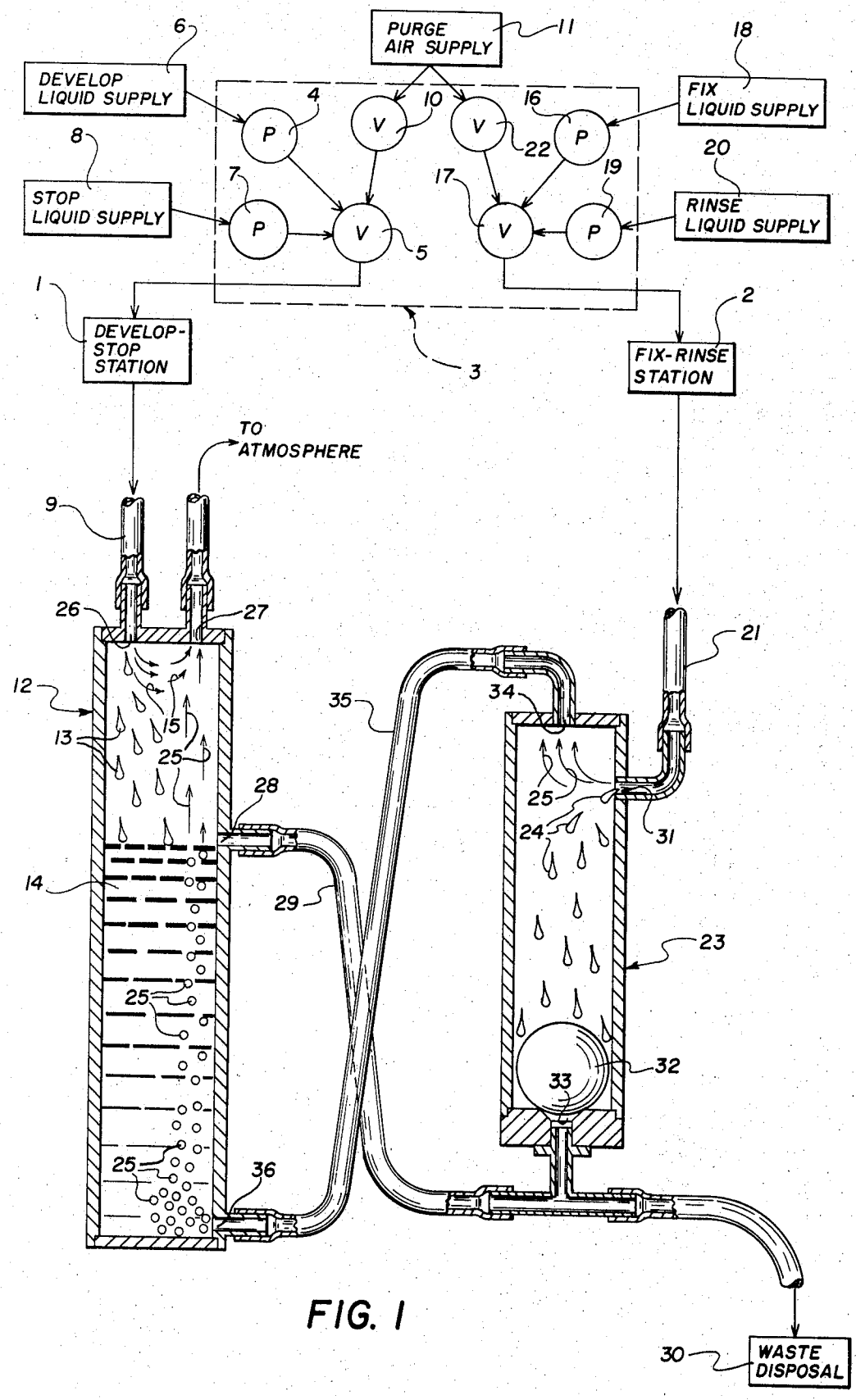

PURGE AIR SUPPLY
11
DEVELOP LIQUID SUPPLY
6
FIX LIQUID SUPPLY
18
STOP LIQUID SUPPLY
8
RINSE LIQUID SUPPLY
20
P
V
4
10
16
22
7
17
19
5
3
1
DEVELOP-STOP STATION
2
FIX-RINSE STATION
TO ATMOSPHERE
9
26
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12
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WASTE DISPOSAL

FIG. 1

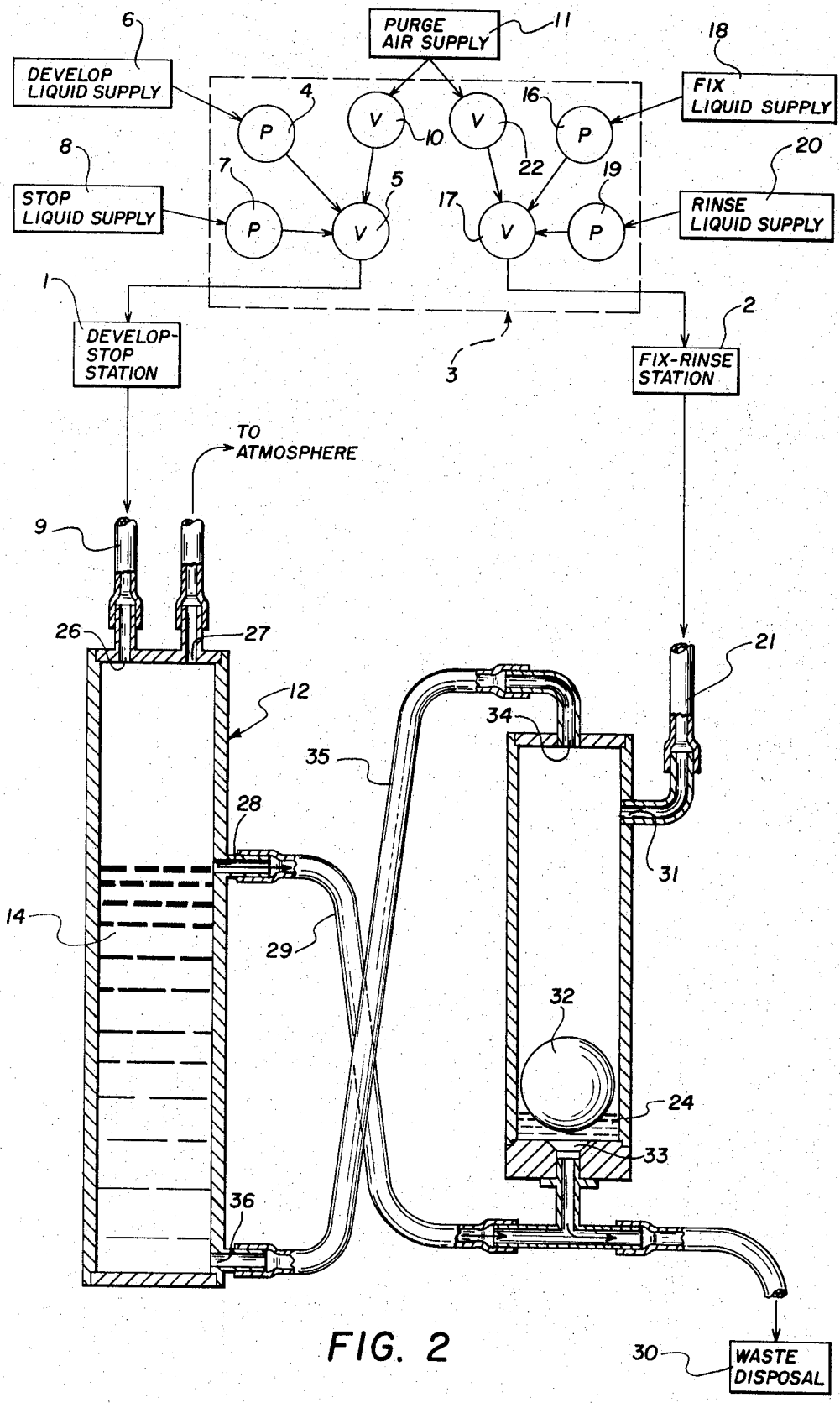

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V
4
10
16
22
7
5
19
17
DEVELOP-STOP STATION
1
FIX-RINSE STATION
2
3
TO ATMOSPHERE
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26
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31
14
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36
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WASTE DISPOSAL

FIG. 2

PHOTOGRAPHIC CHEMICAL WASTE HANDLING APPARATUS AND METHOD

CROSS REFERENCE TO RELATED APPLICATION

Reference is made to commonly assigned copending U.S. patent application Ser. No. 309,311, entitled A METHOD AND APPARATUS FOR PROCESSING A FILM INSERT IN AN APERTURE CARD and filed in the name of Donald J. Stoffel on Nov. 24, 1972.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a photographic chemical waste handling apparatus and method for handling waste chemicals used in the processing of film. More particularly, the invention relates to a photographic chemical waste handling apparatus and method by which a waste gas is passed through a waste liquid to substantially completely remove a noxious substance from the waste gas.

2. Description of the Prior Art

In wet process developing of film, it is well known that various processing fluids must be applied in a given sequence to the film. In attempting to automate such film developing, processor apparatus has been devised wherein metered quantities of different processing fluids are successively applied to film in a processing cavity, with each successive fresh processing fluid serving to supplant the preceding waste fluid in the cavity. Examples of this kind of processor apparatus are disclosed, for instance, in U.S. Pat. Nos. 3,233,532 and 3,525,295 which were respectively patented Feb. 8, 1966 and Aug. 25, 1970.

The processing fluids successively passed through the processing cavity may include a develop liquid containing chemicals such as hydroquinone and phenidone for developing the film image, a stop liquid containing a chemical such as acetic acid for neutralizing the action of the develop liquid, a fix liquid containing a chemical such as ammonium thiosulfate for fixing the film image, and a wash water for rinsing the film. Moreover, the processing fluids may include blasts of pressured air which are passed through the processing cavity to clean or purge the cavity of residue waste liquid and to dry the film as well as the cavity. Should the residue waste liquid in the processing cavity contain a chemical, such as ammonia, which is readily vaporized and which is noxious in its gaseous form, then the air blast may free some of this chemical from the waste liquid. Thereafter, the waste air charged with the chemical, such as ammonia, is discharged into the atmosphere. This practice of discharging the waste air into the atmosphere has obvious shortcomings, since the waste air may contain a concentration of ammonia, for example, which is sufficient to cause a noxious working environment.

It is well known that ammonia may be substantially completely removed from an ammonia and air mixture by passing such mixture through water, since ammonia is very soluble in water. A film processor employing this technique is disclosed, for example, in U.S. Pat. NO. 1,980,469 which was patented Nov. 13, 1934. Such processor apparatus appears to require a fresh water supply for substantially completely removing ammonia, used in the processing of film, from an ammonia and air mixture. The water absorbing ammonia is utilized for no futher purpose, such as washing the film. Another patent, U.S. Pat. No. 3,323,436 which was patented June 6, 1967, discloses a film processor wherein ammonia used in the processing of film is passed through citric acid to substantially reduce the ammonia concentration prior to discharging ammonia fumes into the atmosphere. Here again, as in U.S. Pat. No. 1,980,469, the ammonia absorbent is utilized solely for that purpose.

In view of the foregoing, it will be appreciated that a film processor in which ammonia is a waste chemical and which utilizes at least one of the spent, i.e., used, film processing liquids as an ammonia absorbent, has obvious advantages.

SUMMARY OF THE INVENTION

Therefore, it is separate objects of the present invention to provide a photographic chemical waste handling apparatus and method which, respectively, are improved over the prior art just described.

It is further separate objects of the present invention to provide a photographic chemical waste handling apparatus and method which generally prevent any polluting affect that the waste chemicals might otherwise have on the working environment.

Other separate objects of the present invention are to provide a photographic chemical waste handling apparatus and method which utilizes at least one of the fluids used in the processing of film to generally prevent any polluting affect that the waste chemicals might otherwise have on the working environment.

Still other separate objects of the present invention are to provide a photographic chemical waste handling apparatus and method by which a waste gas is passed through a waste liquid to substantially completely remove a noxious substance from the waste gas.

In accordance with the present invention there is disclosed, in detail hereinafter, a photographic chemical waste handling apparatus and method for handling (*a*) a waste gas of a kind which contains a noxious substance and (*b*) a waste liquid of the kind which can substantially completely remove the noxious substance from the waste gas. The waste gas and the waste liquid, containing chemicals previously used in the processing of film, are brought into contact with each other in a waste holding chamber. During such contact, the waste liquid serves to substantially completely remove the noxious substance from the waste gas. Thereafter, the waste gas is vented from the chamber into the atmosphere without the polluting affect that the noxious substance might otherwise produce.

BRIEF DESCRIPTION OF THE DRAWINGS

The above-mentioned and other features and objects of the present invention and the manner of obtaining them will become more apparent by reference to the following detailed description of a preferred embodiment of such invention taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a sectional view of photographic chemical waste handling apparatus in accordance with a preferred embodiment of the present invention, and is a schematic view of cooperating members of a film processor, showing the flow of waste fluids from such pro-

cessor members to the waste handling apparatus; and

FIG. 2 is a view similar to FIG. 1, showing further operation of the waste handling apparatus.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Because photographic film processors and the general operations associated therewith are well known in the art, the description hereinafter will be directed in particular only to those processor members forming part of, or cooperating most directly with, a method and apparatus in accordance with the present invention. It is to be understood, however, that processor components not specifically shown or described may take various forms selectable from those known in the art.

Referring now to the drawings and in particular to FIG. 1, there is shown in block format certain processor members for successively applying metered or regulated quantities of different processing fluids to exposed film located first in a develop-stop processing station 1 and thereafter in a fix-rinse processing station 2. Structural details of these processing stations 1 and 2 are specifically described in commonly assigned copending U.S. patent application Ser. No. 309,311 (more fully referenced hereinbefore). The processing fluids successively passed through the develop-stop station 1 and applied to the exposed film therein, include a develop liquid containing chemicals such as hydroquinone and phenidone for developing the film image, a stop liquid containing a chemical such as acetic acid for neutralizing the action of the develop liquid, and pressured air for removing any residual waste or spent processing liquid from the develop-stop station and the film. The processing fluids successively passed through the fix-rinse station 2 and applied to the film therein, include a fix liquid containing a chemical such as ammonium thiosulfate for fixing the film image, a rinse water which may contain a chemical such as ammonium hydroxide for rinsing the film, and pressured air for removing any residual waste processing liquid from the fix-rinse station and the film. Naturally, the dwell time of the film in each of the develop, stop, fix and rinse liquids, as well as the temperatures of these liquids, is rather closely controlled for effective image development.

At the onset of the processing cycle, an electromechanical control device 3 momentarily actuates a develop liquid pump 4 and a three-way valve 5 for feeding a "plug" or small quantity (such as 1.6 cc) of develop liquid from a develop liquid supply 6 into the develop-stop station 1. After sufficient develop time (such as 4 seconds) has elapsed, the control device 3 momentarily actuates a stop liquid pump 7 and the three-way valve 5 for feeding a small quantity (such as 1.6 cc) of stop liquid from a stop liquid supply 8 into the develop-stop station 1. The fresh unused stop liquid serves to supplant the waste develop liquid in the developstop station, causing the waste develop liquid to flow into a waste conduit or line 9 which, as shown in FIG. 1, is connected to the develop-stop station. After a sufficient stop time (such as 3 seconds) has elapsed, the control device 3 momentarily actuates a purge air valve 10 and the three-way valve 5 for feeding a blast or charge of pressured air (such as 400 cc at 25 psig) from a purge air supply 11, through the develop-stop station 1 and the waste conduit 9, and into a chemical waste receiving or handling chamber 12 (the details of which are described below). This air blast removes or purges the waste develop and stop liquids from the waste conduit 9 and the develop-stop station 1, respectively, and flushes such waste liquids into the waste receiving chamber 12, within a matter of seconds. FIG. 1 depicts the waste develop-stop liquid, flushed into the chamber 12, as several liquid droplets 13 and a liquid column 14 and depicts the air blast, passed into such chamber, by several arrows 15.

In a like manner, the electro-mechanical control device 3 momentarily actuates a fix liquid pump 16 and a three-way valve 17 for feeding a "plug" or small quantity (such as 1.6 cc) of fix liquid from a fix liquid supply 18 into the fix-rinse station 2. After a sufficient fix time (such as 4 seconds) has elapsed, the control device 3 momentarily actuates a rinse liquid pump 19 and the three-way valve 17 for feeding a small quantity (such as 2.1 cc) of rinse liquid from a rinse liquid supply 20 into the fix-rinse station 2. The fresh unused rinse liquid serves to supplant the waste fix liquid in the fix-rinse station 2, causing the waste fix liquid to flow into a waste conduit or line 21 which, as shown in FIG. 1, is connected to the fix-rinse station. After a sufficient rinse time (such as 3 seconds) has elapsed, the control device 3 momentarily actuates a purge air valve 22 and the three-way valve 17 for feeding a blast or charge of pressured air from the purge air supply 11, through the fix-rinse station 2 and the waste conduit 21, and into another chemical waste receiving or holding chamber 23 (the details of which are described below). This air blast purges the waste fix and rinse liquids from the waste conduit 21 and the fix-rinse staion 2, respectively, and flushes such waste liquids into the waste receiving chamber 23, within a matter of seconds. FIG. 1 depicts the waste fix-rinse liquid, flushed into the chamber 23, as several liquid droplets 24 and depicts the air blast, passed into such chamber, by several arrows 25.

In one particular application of the foregoing develop-stop and fix-rinse processing cycles, an exposed film piece on a KODAK RETNAR camera card was processed using KODAK RETNAR developer, stop, fix and rinse. The temperature of the developer, stop and fix was maintained about 130°F and the temperature of the rinse and purge air was maintained about 90°F. The liquid and air volumes and the processing dwell times for the respective metered quantities of processing fluids were those stated above.

Now considering the details of the waste develop-stop-air receiving chamber 12, it can be seen in FIG. 1 that such chamber has an inlet opening 26 which is connected to the waste conduit 9 and through which the waste air 15 and the waste develop-stop liquid 13, 14 are received into this chamber. A vent opening 27, arranged at the same elevation as that of the inlet opening 26, permits the waste air 15 to escape from the chamber 12 and into the atmosphere. A drain opening 28, arranged somewhat below the inlet and vent openings 26 and 27, allows any amount of waste develop-stop liquid exceeding a given quantity to drain from the chamber 12 as shown in FIG. 2. Such drained liquid enters a drain conduit or line 29, and is conveyed therealong to a waste receptacle or other disposal 30.

The details of the fix-rinse-air waste receiving chamber 23 are shown in FIG. 1. In particular, the chamber

23 has an inlet 31 which is connected to the waste conduit 21 and through which the waste fix-rinse liquid 24 and the waste gas 25 are received into this chamber. The waste fix-rinse liquid 24 accumulates in the chamber 23, as shown in FIG. 2, until a float or ball valve 32 floats in such accumulated liquid, opening a drain opening 33 and allowing the accumulated liquid to drain from the chamber 23. This drained liquid enters the drain conduit 29, and is conveyed therealong to the waste disposal 30. The waste air 25 passed into the chamber 23 is vented therefrom by means of a vent opening 34, arranged slightly above the inlet opening 31. This vented air is conveyed along a vent conduit 35, passing through an inlet opening 36 in the waste develop-stop-air receiving chamber 12. As shown in FIG. 1, the inlet opening 36 serves to introduce the waste air 25 into the chamber 12 at a location bubbling such waste air through the waste develop-stop liquid column 14. After passing through the waste liquid column 14, the waste gas 25 is vented from the chamber 12 and into the atmosphere via the vent opening 27.

As stated hereinbefore, the fresh fix liquid coming from the fix liquid supply 18 may contain ammonium thiusulfate, and the fresh rinse water coming from the rinse liquid supply 20 may contain ammonium hydroxide. Therefore, the air blast which purges the waste fix and rinse liquids from the fix-rinse station 2 and the waste conduit 21 and which moves such waste liquids into the waste receiving chamber 23, frees respective amounts of ammonia from the ammonium thiosulfate and the ammonium hydroxide. The ammonia released from the ammonium thiosulfate is less in amount than that released from the ammonium hydroxide, since as is well known ammonia is more easily vaporized from ammonium hydroxide than from ammonium thiosulfate. When the waste air 25 charged with the ammonia is bubbled through the waste develop-stop liquid column 14 in the waste receiving chamber 12, the ammonia is substantially completely absorbed by such waste liquid. This separation of the ammonia from the waste air 25 occurs due to the fact that the waste develop-stop liquid contains water and acetic acid (though water alone is sufficient to bring about this ammonia separation). Accordingly, venting of the waste air 25 from the chamber 12 and into the atmosphere generally does not bring about any polluting affect that might otherwise occur should the ammonia remain in such waste air.

Although FIGS. 1 and 2 show the develop-stop station 1 and the fix-rinse station 2 as occupying different locations in a processing region of a processor, it will be appreciated by one having ordinary skill in the art that these stations could just as well occupy the same location in the processing region.

The present invention has been described in detail with particular reference to a preferred embodiment thereof, but it will be understood that variations and modifications can be effected within the spirit and scope of the invention.

We claim:

1. An improved photographic processor, wherein there is provided a processing region at which photographic material is processed and from which there is separately discharged (*a*) a waste gas of the kind which may contain a noxious substance and (*b*) a waste liquid of the kind which can substantially completely remove the noxious substance from such waste gas, and wherein the improvement comprises:

means defining a chamber for receiving such waste gas and such waste liquid;

means for conveying such waste liquid from said processing region into said chamber; and

means for conveying such waste gas from said processing region to said chamber and for introducing the waste gas into said chamber at a location passing the waste gas through such waste liquid in said chamber to substantially completely remove the noxious substance from the waste gas.

2. The improvement as recited in claim 1, further comprising:

means disposed on said chamber defining means for draining from said chamber, any amount of such waste liquid which exceeds a given quantity;

a waste receptacle; and

means for conveying such waste liquid from said draining means into said waste receptacle.

3. The improvement as recited in claim 2, further comprising:

means disposed on said chamber defining means for venting from said chamber, such waste gas from which the noxious substance has been substantially completely removed.

4. A photographic chemical waste handling apparatus for handling (*a*) a waste gas of the kind which contains a noxious substance and (*b*) a waste liquid of the kind which can substantially completely remove the noxious substance from such waste gas, said apparatus comprising:

means defining a chamber for receiving such waste gas and such waste liquid, and for storing a given quantity of the waste liquid;

means disposed on said chamber defining means for draining from said chamber, any amount of such waste liquid which exceeds the given quantity;

a waste receptacle;

means for conveying such waste liquid from said draining means into said waste receptacle;

means for introducing such waste gas into said chamber at a location passing the waste gas through such waste liquid in said chamber to substantially completely remove the noxious substance from the waste gas; and

means disposed on said chamber defining means for venting from said chamber, such waste gas which has passed through such waste liquid.

5. A photographic chemical waste handling apparatus for handling (*a*) a first waste liquid, (*b*) a waste gas of the kind which contains a noxious substance, and (*c*) a second waste liquid of the kind which can substantially completely remove the noxious substance from such waste gas, said apparatus comprising:

means defining a first chamber for receiving such first waste liquid and such waste gas together, and for allowing separation of the two;

means disposed on said first chamber defining means for draining from said first chamber, such first waste liquid separated in said first chamber from such waste gas;

means defining a second chamber for receiving such second waste liquid and such waste gas individually, and for storing a given quantity of the second waste liquid;

means disposed on said second chamber defining means for draining from said second chamber, any amount of such second waste liquid which exceeds the given quantity;

means for conveying such waste gas from said first chamber to said second chamber and for introducing the waste gas into said second chamber at a location passing the waste gas through such second waste liquid in said second chamber to substantially completely remove the noxious substance from the waste gas; and

means disposed on said second chamber defining means for venting from said second chamber, such waste gas which has passed through such waste liquid.

6. A photographic chemical waste handling apparatus for handling (*a*) a first waste liquid, (*b*) a waste gas of the kind which contains ammonia and (*c*) a second waste liquid of the kind which can substantially completely absorb the ammonia from such waste gas, said apparatus comprising:

means defining a first fixed volume chamber for receiving such first waste liquid and such waste gas together, and for allowing separation of the two;

said first chamber defining means including an inlet opening for receiving such first waste liquid and such waste gas in said first chamber, a vent opening located above said gas and first liquid inlet opening for venting the waste gas from said first chamber, and a drain opening located below said gas and first liquid inlet opening for draining the first waste liquid from said first chamber;

a float valve located within said first chamber for opening and closing said first liquid drain opening;

means defining a second fixed volume chamber for receiving such second waste liquid and such waste gas individually, and for storing a given quantity of the second waste liquid;

said second chamber defining means including a drain opening for draining such second waste liquid from said second chamber, an inlet opening located above said second liquid drain opening for receiving the second waste liquid in said second chamber, an inlet opening located below said second liquid drain opening for receiving such waste gas in said second chamber to bubble the waste gas through the second waste liquid in said chamber, and a vent opening located above said second liquid drain opening for venting the waste gas from said second chamber;

means connecting said gas vent opening on said first chamber defining means and said gas inlet opening on said second chamber defining means for conveying such waste gas from said first chamber to said second chamber;

a waste receptacle; and

means for conveying such first waste liquid from said first liquid drain opening on said first chamber defining means to said waste receptacle and for conveying such second waste liquid from said second liquid drain opening on said second chamber defining means to said receptacle.

7. A photographic chemical waste handling method for handling (*a*) a waste gas of the kind which contains a noxious substance and (*b*) a waste liquid of the kind which can substantially completely remove the noxious substance from such waste gas, said method comprising:

conveying such waste liquid from a film processing region to a chemical waste receiving chamber;

conveying such waste gas from the processing region to the receiving chamber;

bubbling such waste gas in the receiving chamber through such waste liquid in the chamber to substantially completely remove the noxious substance from the waste gas; and

venting from the receiving chamber, such waste gas which is passed through such waste liquid.

8. A photographic chemical waste handling method for handling (*a*) a waste gas of the kind which contains a noxious substance and (*b*) a waste liquid of the kind which can substantially completely remove the noxious substance from such waste gas, said method comprising:

conveying such waste liquid from a film processing region to a chemical waste receiving chamber;

storing a given quantity of such waste liquid in the receiving chamber;

draining from the receiving chamber, any amount of such waste liquid which exceeds the given quantity;

conveying such waste gas from the processing region to the receiving station;

introducing such waste gas into the receiving chamber at a location bubbling the waste gas through such waste liquid in the chamber to substantially completely remove the noxious substance from the waste gas; and

venting from the receiving chamber, such waste gas which is passed through such waste liquid.

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