APPARATUS FOR NEUTRALIZATION OF ETCHING EMULSIONS

Filed Sept. 6, 1963

Fig. 1
The present invention relates to an apparatus for the neutralization of etching emulsions.

Etching emulsions, which, in order to bring about a continuous etching method, gain always greater importance, must or should be neutralized and degreased, prior to their feeding into conventional sewers or other public waste-waters. Particularly, the grease component simultaneously contained in such etching emulsions causes extensive difficulties, particularly in case an apparatus is to be provided which works in a continuous process. All these difficulties are for their greatest part due to the fact, that the manufacturers of the etching emulsions aim, as much as possible, to avoid a separation of the phases of the etching emulsions, since such separation is of a disadvantage for the etching process itself.

The known apparatus for the neutralization of etching emulsions use neutralization containers and filtering devices for the separation of the precipitated zinc hydroxide, whereby the neutralization container and the filtering device are positioned after an oil separator. These devices cannot operate, however, in a continuous process. First of all, the oil separators can reach the state of overflow, if the oil is not timely removed. In other devices cleansing cartridges are used for the separation of the grease component from the emulsion. This cleansing cartridge must be exchanged at the right time. The known devices have also a very small output, which amounts to about 12 l. per hour. The output from the large modern one-step etching machines is, however, substantially greater. It must be taken into consideration herein, that also the cleansing processes in the etching machine following the etching process lead to waste waters, which must pass a neutralization apparatus, so that practically the capacity of the neutralization apparatus must receive, and permit passing, respectively, the quadruple bath quantity of the etching machine. If a continuous working cycle is to be obtained, without shutting off the etching machine.

It is, therefore, one object of the present invention to provide an apparatus for the neutralization of etching emulsions in which, in spite of the great quantities of liquids and in spite of the grease content to be handled, it is possible to work in a continuously operating process, and in particular without the danger that in case of a greater waste water output, the grease-free state and the required neutralization cannot be achieved.

It is another object of the present invention to provide an apparatus for the neutralization of etching emulsions wherein the oil separator, following a quietlyetted container by means of a feeding pipe, is provided with inclined separation walls, which terminate in oil receiving chambers, to which overflow openings are coordinated which are disposed above the remaining liquid level occurring in the oil separator. This liquid level is determined by an overflow run-off leading to the neutralization container.

Due to this arrangement, an apparatus, and particularly an oil separator, is realized, which operates without attendance and with a great circulation capacity and which, furthermore, also enables, as it has been found out by extensive tests, the absolute removal of grease from the acid fed into the neutralization container. The number of the inclined separation walls disposed in the oil separator depends upon the phase stability of the passing etching emulsion. Under certain circumstances one single separation wall suffices in order to reach the grease-free state. The removed grease passes through the overflow openings of the oil receiving chambers into separate containers. It is thus not required to skim off the grease component, so that there occurs never the danger, that the capacity of the oil separator is overcharged and that oil is fed into the neutralization container.

It is another object of the present invention to provide an apparatus for the neutralization of etching emulsions wherein the overflow output of the oil separator leads into a neutralization container the content of which is subjected to constant mixing by means of a driven wing-wheel and into which neutralization container the neutralization lye is fed within the range of the whirl zone of the vane. It has been found in particular, that this arrangement permits an extremely exact adjustment of the pH-value.

It is still another object of the present invention to provide an apparatus for the neutralization of etching emulsions wherein the neutralization container has an overflow branch leading to the filtering device. The feeding of the neutralized liquid in an overflow process ensures, that in the removed liquid all of the precipitated particles of zinc hydroxide are most favorably in suspension. A clogging of the pipe leading from the neutralization container to the filtering device and also a sudden overcharging of the filtering device with zinc hydroxide are prevented.

It is yet another object of the present invention to provide an apparatus for the neutralization of etching emulsions wherein the feeding conduit to the oil separator terminates below the lowermost separation wall of two oppositely directed separation walls. The liquid level in the oil separator is then maintained by a feeding below the liquid level and below the lowermost disposed separation wall, which assures a safe effect from all separation walls of the oil separator and also ensures a calm influent.

It is still further an object of the present invention to provide an apparatus for the neutralization of etching emulsions wherein a high increase of the grease separation effect of the oil separator is brought about by downwardly directed extensions provided at the free ends of the separation walls. A still further increase, particularly at higher circulation speeds, can be brought about, according to the present invention, by blowing air into the oil separator at its bottom, preferably, by means of spraying pipes. The air bubbles rising from the bottom of the oil separator preferably drag along the grease component and due to the special structure of the oil separator also into oil chambers provided therefor.

It is yet a further object of the present invention to provide an apparatus for the neutralization of etching emulsions wherein the overflow branch of the neutralization container terminates in a perforated riser pipe which extends into a filter bag suspended in a receiving container. This arrangement ensures that the filter device is also sufficient with safety to the oncoming circulation, and particularly that even then a sufficient passage is obtained, when the filter bag is filled increasingly with zinc hydroxide.

It is another object of the present invention to provide an apparatus for the neutralization of etching emulsions which is adapted for a continuous operation, in which the supply pipe leading to the riser pipe is formed as a swingable cantilever pipe arm and in which a plurality of filter bags are suspended adjacent each other in the receiving container. If one filter bag is filled up, the riser pipe can be inserted into the next filter bag by a very short manual gripping operation. Advantageously the riser pipe is
loosely mounted on the cantilever pipe arm for this reason.

It is also an object of the present invention to provide an apparatus for the neutralization of etching emulsions in such a manner that the filtering device, which is brought about in another embodiment such that the filtering device comprises a through-hanging filter paper strip carried by a revolving carrier sleeve. In adopting this structure, the use of special filter bags and the observation of these bags, in order to avoid an overcharging, or a clogging up of the filtering device, operating with a carrier sleeve, it is advantageous if, according to the present invention, the filter paper strip is drawn off a storage roll by driving the carrier sleeve and pushed into a waste chamber together with the filtered zincy hydroxide. In order to bring about that the filtering device does not require any attendance at all, it can be of advantage, in accordance with the present invention, to control the stepwise advancing movement of the carrier sleeve by means of a float extending into the space defined by the through-hanging paper strip. If the liquid level in that space rises, the rising of the float causes the operation of a switch for starting the stepwise advancement of the carrier sleeve. The rise of the liquid level in that space is caused by the zinc hydroxide, which forms a deposit on the filter paper strip and impairs its permeability. If now by the stepwise advancing movement of the carrier sleeve movement of the filter paper arrives below the overflow branch of the neutralization container, an increased passage through the filter paper is again obtained; the liquid level is lowered and the float causes a switching off of the stepwise advancing movement.

It is still a further object of the present invention to provide an apparatus for the neutralization of etching emulsions in which the filtering device for the separation of the precipitated zincy hydroxide is adjusted to the continuous and fast working speed of the oil separator in a simple and foolproof manner, such that the filtering device provided behind the neutralization container has a plurality of filter bags suspended adjacent each other and connected with each other by overflow branches. In this structure, the operating periods possible without any supervision and attendance are substantially increased. The riser pipe extending into a filter bag may also remain therein, even if this filter bag is already filled up with zincy hydroxide deposited to a considerable extent. By means of the overflow branches the adjacent filter bags join then the filtering process either stepwise or simultaneously. If, for example, three adjacent filter bags connected with each other by overflow branches are selected and the riser pipe extends into the center filter bag, no obstacles are encountered for the participation by the outer adjacent filter bags in the filtering process, if, due to a large amount of liquid fed through the riser pipe, the liquid to be filtered rises to the level of the overflow branches.

It is still another object of the present invention to provide an apparatus for the neutralization of etching emulsions, in which, in an advantageous embodiment, the overflow branches are telescopically receiving each other. This arrangement simplifies not only the suspension of the filter bags, but also anticipates the danger of destruction of such filter bags at the walls of the filtering device, which danger is to be considered particularly with such filter bags, which have been used before and are heavily filled up. A further advantageous structure developed in this direction comprises, according to the present invention, a plurality of groups of individual filter bags connected with each other, the group of such filter bags being separated from each other. This arrangement brings about the possibility that after complete filling of one group of filter bags, the other group can be joined in the filtering process, while during the operating period of the other group, the first group is emptied or readied for a new operation. For reasons of security, particularly during this shifting from one group to another, it is, according to the present invention, advantageous, if all filter bags are surrounded by a filter envelope.

With these and other objects in view which will become apparent on following the detailed specification, the present invention will be clearly understood in connection with the accompanying drawings, in which:

FIGURE 1 is a front elevation of the apparatus, the filtering device being omitted for the purpose of better demonstration and partly broken away;

FIG. 2 is a side elevation of the apparatus disclosing one side thereof, and the neutralization container being partially broken and the filtering device being shown in section;

FIG. 3 is a side elevation of the apparatus disclosing the other side thereof, and the oil separator being shown partly in section;

FIG. 4 is a side elevation of the filtering device, disclosing another embodiment thereof;

FIG. 5 is a top plan view of the filtering device shown in FIG. 4, and

FIG. 6 is a section of a third embodiment of the filtering device along the lines 6—6 of FIG. 8;

FIG. 7 is a similar section of the third embodiment of the filtering device shown as FIG. 6; and

FIG. 8 is a top plan view of the filtering device disclosed in FIG. 6.

Refer now to the drawings, and particularly to FIGS. 1 to 3, the apparatus comprises an input container 1, a quieting container 2, an oil separator 3, a neutralization container 4 and a receiving container 5 included in the filtering device.

The input container 1, which is formed as a base for the neutralization container 4, has an input branch 6. The latter communicates with the output branch of an etching machine (not shown). A float 7 extends into the input container 1. A drive motor 9 for a pump 10 is disposed on an extension 8 of the base. The output of the pump 10 is greater than the feed through the input branch 6. The pump 10 passes the liquid from the container 1 into the quieting container 2 by means of a conduit 11. The free end 11' of the pipe conduit 11 extends considerably into the quieting container 2, and in particular, preferably, at least if the free end 11' is always situated below the liquid level 12 for any and all amounts of liquid to be received. If a certain predetermined amount of liquid is not fed into the input container 1, the float 7 switches off the drive motor 9, if the amount of liquid in the input container increases again, the float 7 switches on again the drive motor 9.

In case the entire apparatus is located at a substantially lower level than that of the etching machine, for example in the basement, while the etching machine is located on the first floor of the same building, the drive motor 9 and the pump 10 can be dispensed with, since the liquid is moved into the quieting container 2 by means of hydrostatic pressure.

The liquid is at first subjected in the container 2 to a quieting procedure. Furthermore, the quieting container 2 constitutes a receiving container, in order to be capable of receiving about the quadruple amount of the bath of the etching machine and of all etching machines, respectively, of the filtering device, thereafter, taking into consideration the reduced output from the quieting container 2, for reasons set forth below.

The quieting container 2 is equipped with a feeding conduit 13 which leads to the oil separator 3. The limitation to a predetermined amount of liquid fed to the oil separator 3 is brought about by a reduction of the cross section of the feeding conduit 13. In this case, which are designed for a capacity of about 500 l. about 3 l. per minute are fed off from the quieting container 2; in apparatus having a capacity of 1000 l., about 6 l. are fed off per minute. Furthermore, a magnetic valve 14 is provided in the feeding conduit 13. The magnetic valve 14 switches
off automatically the inlet to the oil separator 3, if certain predetermined and previously set pH-values are not maintained, since the magnetic valve 14 is responsive by conventional means to any predetermined pH-values. Simultaneously, herewith an alarm device is put into operation. If oil separator 3 inclined separation walls 15 and 16 are provided. The latter are equipped at their free ends with downwardly projecting extensions 15' and 16'. The free end 13' of the sealing conduit 13 extends below the bottom face of the lowermost of the separation walls 16 into the oil separator 3. The separation walls 15 and 16 extend over the entire width x of the oil separator 3 (FIG. 1). The oil separator 3 has a side wall 3' and the free end 16' of the separation wall 16 terminates at a certain distance from the wall 3' thereby defining a space 17 therebetween, and correspondingly, the separation wall 15 terminates at a certain distance from the separation wall 16, thereby defining a space 18 between the separation walls 15 and 16. The separation walls 15 and 16 are provided at their ends opposite those having the extensions 15' and 16' with upwardly bent extensions 19 and 20, respectively, which jointly with the closest adjacent wall of the oil separator 3 define oil receiving chambers 21 and 22, respectively. An overflow conduit 23 is coordinated to the oil receiving chamber 21 and an overflow conduit 24 is coordinated to the oil receiving chamber 22. Both conduits 23 and 24 lead to a common feed-off conduit 25, which terminates into an oil receiving container 26.

Spray tubes 27 are provided at the bottom of the oil separator 3. The spray tubes 27 have upwardly directed openings 28 and are connected to a source of pressurized air or of another pressurized gas. The pressurized air enters into the bath 30 of the oil separator 3 under low pressure in form of individual bubbles 29, which rise through the bath 30.

Independently from the rising of the bubbles 29, and also taken along with the bubbles 29, oil particles 31 will rise likewise. The rising oil particles are at first guided essentially by the inclined separation wall 16 into the oil receiving chamber 22. The extension 16' of the separation wall 16 prevents thereby to the greatest extent that oil is dragged along through the space 17. Even if, however, any oil is dragged along therethrough, this oil rises, deviated by the oppositely directed inclined separation wall 15, into the separation chamber 21. Due to the different specific weights of oil and the remaining liquid in the oil separator 3, the oil levels 32 and 33 in the oil receiving chambers 21 and 22 are higher than the remaining level 34 of the liquid between the upwardly bent extensions 19 and 20 in the oil separator 3.

The remaining level 34 is determined by an overflow feed-off 35 of the oil separator 3. The completely grease-free etching liquid escapes through the overflow feed-off 35. It flows into the neutralization container 4, and in particular, by means of the inlet pipe 35', which terminates at a short distance above the liquid level 36 prevailing in the neutralization container 4.

A wing wheel 37 extends into the neutralization container 4, which wing wheel 37 is mounted on a shaft 38 coupled with a driving motor 39. Furthermore, a measuring probe 40 extends also into the neutralization container 4 for the determination of the prevailing pH-value. Moreover an inlet pipe 41 extends likewise into the neutralization container 4, which inlet pipe 41 is connected by means of an intermediate magnetic valve 42 to a storage container 43 containing the neutralizing lye, for example caustic soda. The free end 41' of the inlet pipe 41 terminates, preferably with an angular cranking, in the area of the swirl zone of the wing wheel 37.

The measuring probe 40 is connected with a switching and control device 44 which carries also the different operating knobs for starting and stopping the operation of the apparatus and which is furthermore provided with a pH-measuring and recording device 45. The magnetic valve 42 is also controlled by the switching and control device 44 in such manner that the caustic soda is at first added at intervals. If the pH-value in the neutralization container 4 varies from its predetermined value or if it does not reach this value after a predetermined time period, then the instantaneous value is further in the acidic range than the index values set on the device 44 require, a continuous feeding of neutralization lye is brought about by a corresponding control of the magnetic valve 42. If the instantaneous value in the neutralization container 4 remains for a predetermined time period outside of the index value and index interval, respectively, set on the switching and control device 44, the alarm device is put into operation and, as already described above, the magnetic valve 14 is closed.

The neutralization container 4 is provided with an overflow branch 46 to which a swingable cantilever pipe arm 47 is connected. A riser pipe 48 is loosely attached to the front end of the cantilever pipe arm 47 and is provided with holes 49, as well as extends into a filter bag 50 which is suspended from the rods 51 in the receiving container 5. The latter has an outlet 52 which can be connected with the public waste-water system.

The neutralized liquid 53 emerging from the overflow branch 46 contains finely divided the precipitated zinc hydroxide 54, which is collected in the filter bag 50. A plurality of filter bags 50 disposed in series, preferably in longitudinal direction, are suspended in the receiving container 5. By swinging the cantilever pipe 47, the flow can be directed into the corresponding filter bag 50. For swinging the cantilever pipe arm 47, the riser pipe 48 is pulled off in the direction of the arrow y (FIG. 2), removed from the filled filter bag 50, under circumstances cleaned and inserted into the next filter bag 50, whereupon it can be put again on the correspondingly turned cantilever pipe arm 47.

Referring now again to the drawings, and in particular to FIGS. 4 and 5, another embodiment of the filtering device is disclosed. An endless revolving carrier sleeve 55 is provided at the upper part of the receiving container 5'. A filter paper strip 56 is overlaying the carrier sleeve 55 and taken from a storage roll 57. The carrier sleeve 55, including the filter paper strip 56, is suspended to define a particular space 63. An inlet receptacle 58 terminates at the longitudinal axis of this space 63, the neutralized liquid, emerging from the cantilever pipe arm 47, being fed into the inlet receptacle 58. In order to support and to maintain the shape of said space carrier rollers 59 are provided at the side walls of the receiving container 5'.

A drive motor 60 is operatively connected with return pulleys 61 of the endless revolving carrier sleeve 55. The drive motor 60 is controlled by a float 62 which penetrates into the space 63. If the liquid level rises in the space 63 above a predetermined point, so that a danger would be created that the liquid flows over laterally, the float 63 will cause to switch on the motor 60. New filter paper 56 is then taken off the storage roll 57. Simultaneously, the previously used filter paper including the layer of filtered out zinc hydroxide disposed on the filter paper is pushed off into a waste container 64. Since the new filter paper is extremely more permeable, the liquid level is lowered again in the space 63, whereupon the float 62 stops again the motor 60. The receiving container 5' is equipped with an outlet opening 52', which can lead again into the conventional public waste-water sewers. The liquid level 66 can be controlled in the receiving container 5' by means of a viewing glass 65.

One of the axles 61' of the return pulleys 61 of the endless revolving carrier sleeve 55 is adjustable in order to bring about a resetting, particularly for the accommodation of the depth of the space 63 in longitudinal direction.

Referring now again to the drawings, and in particular to FIGS. 6 to 8, still another embodiment is disclosed according to which the filter device is provided with
filter bags 68, 69, 70, 71, 72 and 73, which are suspended from rods 77 in the receiving container 5'. The latter is equipped with an outlet 52, which can be connected with the public waste-water system. The filter bags 68, 69 and 70 are connected with each other by means of telescoping overflow branches 67. The filter bags 71, 72 and 73 in turn are likewise connected by telescoping overflow branches 67. Accordingly, the filter bags 68, 69 and 70 form a joint group; the filter bags 71, 72, and 73 form likewise a joint group. In the operation of this device the riser pipe 48 can now be inserted either into the first filter bag 68 (FIG. 7) or into the center filter bag 69 (FIG. 6). The riser pipe 48 can remain in this position until the capacity of the group formed by the bags 68, 69 and 70 is exhausted. Only then is it necessary to insert the riser pipe 48 into one of the filter bags 71, 72, or 73. A common envelope 74 of filter material extends about the filter bags 68, 69, 70, 71, 72 and 73. The envelope 74 is supported by carrying rods 75 resting on brackets 76.

While I have disclosed several embodiments of the present invention, it is to be understood that these embodiments are given by example only and not in a limiting sense, the scope of the present invention being determined by the objects and the claims.

I claim:

1. An apparatus for the neutralization of etching emulsions comprising
   an input container,
   a neutralization container supported by said input container and including means for neutralizing liquid received therein,
   a quieting container disposed adjacent said input container,
   an input branch leading into said input container and adapted to be connected with an etching machine,
   first conduit means feeding liquid from said input container into said quieting container,
   an oil separator disposed adjacent said quieting container and including means for separating oil from said liquid,
   second conduit means leading from said quieting container to said oil separator,
   a receiving container disposed adjacent said neutralization container and communicating with the latter,
   outlet means in said receiving container,
   means disposed in said receiving container for filtering out zinc hydroxide precipitated from said neutralized liquid,
   said neutralization container and said receiving container including said filtering means being disposed such to follow said oil separator,
   said oil separator following said quieting container and being in communication with the latter,
   said oil separator including a plurality of inclined separation walls and defining oil receiving chambers at the higher end of each of said separation walls,
   said separation walls terminating into the corresponding of said oil receiving chambers,
   said oil receiving chambers having oil openings coordinated thereto and said overflow openings feeding-off oil from said oil receiving chambers,
   said overflow openings being disposed at a level higher than that of the remaining liquid in said oil separator, and
   an overflow outlet leading from said oil separator to said neutralization container and determining the liquid level of the liquid remaining in said oil separator upon separating said oil therefrom.

2. The apparatus, as set forth in claim 1, wherein said neutralization container has a wing wheel adapted to subject liquid received therein from said oil separator to continuous mixing by means of said overflow outlet, means to rotate said wing wheel, said wing wheel causing, upon rotation thereof, a whirl zone in said neutralization container, and

3. The apparatus, as set forth in claim 2, which includes a second overflow-outlet leading from said neutralization container to said filter means.

4. The apparatus, as set forth in claim 1, wherein said second conduit means, leading from said quieting container to said oil separator, terminates below the bottom face of the lowestmost of said separation walls, and said separation walls are disposed in supereer position and extend as to their inclination in opposite directions.

5. The apparatus, as set forth in claim 1, wherein said separation walls have at their free lower end a downwardly extending projection.

6. The apparatus, as set forth in claim 1, which includes spray tubes disposed within and at the bottom of said oil separator, and said spray tubes are adapted to feed gases into said oil separator.

7. The apparatus, as set forth in claim 1, which includes a second overflow-outlet leading from said neutralization container to said filter means at least one filtering bag suspended in said receiving container, and a perforated riser pipe extending into said filtering bag and connected with said second overflow-outlet.

8. The apparatus, as set forth in claim 7, which includes a connecting tube for connecting said second overflow-outlet with said riser pipe, said connecting tube constituting a swingable pipe arm, and a plurality of said filtering bags are disposed adjacent each other and receiving selectively said riser pipe.

9. The apparatus, as set forth in claim 1, wherein said filtering means comprises an endlessly moving carrier sieve, and a filter paper strip carried by and hanging through on top of said carrier sieve.

10. The apparatus, as set forth in claim 9, which includes means for moving said carrier sieve, a storage roll for feeding said filter paper strip along said carrier sieve, said filter paper strip being pulled along by the movement of said carrier sieve, and a waste chamber disposed adjacent said receiving container and receiving said filter paper strip together with zinc hydroxide filtered out from said liquid and deposited therein.

11. The apparatus, as set forth in claim 9, which includes a float disposed in said receiving container within the space defined by said hanging-through filter paper strip, and means responsive to the level position of said float in said liquid for controlling the movement of said carrier sieve.

12. The apparatus, as set forth in claim 1, wherein said filtering means comprises a plurality of filtering bags disposed adjacent each other, and an overflow branch disposed between each space of said adjacent filtering bags.

13. The apparatus, as set forth in claim 12, wherein said overflow branch comprises two tubes telescopically disposed within each other, in order to adjust the axial length of said overflow branch to the distance between each pair of said filtering bags.

14. The apparatus, as set forth in claim 12, which includes means for feeding neutralization lye toward said whirl zone of said neutralization container.
a plurality of groups of said filtering bags, each of said groups being separated from the other of said groups, and said filtering bags of each of said groups being connected with each other.

15. The apparatus, as set forth in claim 12, which includes

a filtering envelope receiving all said filtering bags.

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No references cited.