CONTACT BODIES FOR LIQUID AND GAS
Sven J. H. Bredberg, Trollhacken, Sweden, assignor to Carl Munters & Co., Stockscund, Sweden

Filed June 25, 1963, Ser. No. 290,422
Claims priority, application Sweden, June 27, 1962, 7,156/62
4 Claims. (Cl. 261—29)

This invention relates to contact bodies for liquid and gas. More particularly, this invention relates to a contact body for liquid and gas which is composed of layers or sheets made with folds between which channels or passageways penetrating through the body are formed. The two fluids are caused to act upon one another during their passage through the channels, such action being performed preferably but not necessarily under cross flow. Such contact may consist in moistening an air stream by means of water while simultaneously cooling said air stream. Another field of application of the invention is constituted by cooling towers containing a contact body or packing in which a liquid, preferably water, is cooled by a small portion thereof being allowed to evaporate into a gaseous fluid, preferably air.

One main object of the invention is to provide a contact body which keeps a high yield of exchange between the two fluids. Another object of the invention is to provide an economy saving in sheet material for a predetermined effect of the contact body. A substantial advantage resides in the feature that the contact body can be constructed as a stationary structure while satisfying high demands regarding compactness and top efficiency.

Further objects and advantages of the invention will become apparent from the following description, considered in connection with the accompanying drawings, which form part of this specification and of which:

FIG. 1 is a vertical longitudinal section following line I—I of FIG. 2 through an apparatus constructed according to the invention for the moistening of air; FIG. 2 is a cross-section along line II—II of FIGURE 1; FIG. 3 is a perspective view of a portion of a contact body; FIG. 4 is a vertical longitudinal section through a cooling tower containing a packing made according to the invention; and FIG. 5 is also a vertical longitudinal section through a modified embodiment of a cooling tower of the type in consideration.

In the various figures, the same reference numerals have been used for equivalent parts.

In the embodiment shown in FIGS. 1—3, a contact body denoted by 10 is enclosed within a casing 12 formed at its bottom to constitute a water collector 14. The casing has an intake 16 and an exhaust 18 for the air to be moistened or cooled, respectively.

The contact body 10 consists of thin layers or sheets which preferably all are folded or corrugated and which are disposed vertically. The corrugations extend at an oblique angle, such as 45° relative to the horizontal plane. Every second layer has its corrugations 20 positioned obliquely in one direction and every second layer has its corrugations 22 extending in the other direction. In this way there are obtained over the whole front face of the contact body channels penetrating said body from one side to the other in the direction of flow of the air indicated by arrow 24. In said direction of flow the channels have a constantly varying width from zero at the contact places between the layers to the double height of the corrugations. The height of the corrugations may amount to 1—7 millimeters, and even more. Also in the vertical direction between an upper spreader member 26 and the lower water collector 14 channels penetrating through the entire contact body are formed, said channels in the same manner having a constantly varying width. The channels in both the horizontal and the vertical directions have a serpentine-like shape. Each drop of liquid falling down from the spreader member 26 will thus abut against a layer in the upper part of a body.

Preferably, the layers are liquid or water absorbing. They may to particular advantage be made of sheets of fibres of cellulose or inorganic material, such as asbestos. Paper sheets or organic or inorganic kind are imparted required mechanical strength in wet condition by impregnation with substance suited therefor, such as a resin, for example a phenolic aldehyde resin. The sheets are interconnected at the places of contact by means of such a resin, for example. The layers may also be subjected to a treatment of the kind set forth in the co-pending patent Application Serial No. 254,131, filed January 28, 1963, by Carl Georg Munters.

The water is caused to circulate between the spreader member 26 and the collector 14 by means of a pump 30 provided in a conduit 28. Fresh water is supplied through a pipe 32 co-operating with a valve 36 commanded by a float 34. Through a pipe 38 provided with a valve 40 water may be drained off to keep the content of salts accompanying the water at a low level, said content increasing to the same degree as the evaporation of the circulating water quantity is continued and thus being able to attain undesirable high values.

During operation of the apparatus, the two fluids pass through the contact body 10 in a cross-flow which means that the main flow direction 24 of the air is horizontal and the main flow direction 38 of the water is vertical. The air is subjected to a constant change of movement of direction due to the shape of the channels and the vortex motion created thereby has a favourable effect on the desired contact between the air and the water. The latter is absorbed by the layers and spread over the whole layer surface of the contact body. This effect is increased by the corrugations 20, 22 extending at different directions. Simultaneously with its downward flow the water follows the ridges of the obliquely positioned corrugations and is thereby distributed in an outward direction toward the lateral faces of the contact body.

The embodiment illustrated in FIG. 4 is shown applied to a cooling tower, the casing 62 of which may have opposite intakes for the air as indicated by the arrows 66, 68. In spaced relation from one another two contact bodies 68 of the structure described are disposed. Water is supplied to them at the top face by means of spreading devices 26. Towards the bottom the casing 62 forms a collector 74 for water, the level of which is kept at a predetermined level by supply of fresh water controlled by the float 34 in a similar manner as in the embodiment shown in FIGS. 1 to 3. Air may be sucked through both contact bodies 68 by means of a common fan 70 rotated by a motor 72. The moist, consumed air escapes through an outlet 74. The cooled water is passed through a pipe 76 provided with a pump 78 to the place of use in order thereupon to be recirculated to the spreading device 26 in known manner.

The cooling tower illustrated in FIG. 5 has two contact bodies 80, 82 arranged in series one behind the other. The water is caused to be fed through a pipe 84 and a spreading member 92 initially to the contact body 82 which is the last to be passed by the air flowing in the direction indicated by the arrow 24. The water is cooled in the contact body 82 during its downward flow through said body and is collected in a collector 94. Therefrom the water is conducted through a pipe 91 and by means of
a pump 90 to a spreading member 84 arranged at the top face of the second contact body 80. During its downward passage through said contact body the water is subjected to a further cooling and is finally withdrawn from the base collector 86 through the pipe 76 and the pump 78. Thus the liquid or water may be brought more than one time into contact with the gaseous fluid or the air by means of the coupling in series of a plurality of contact bodies. Thereby the yield is improved in a direction towards the result obtainable by a flow of the fluids in pure counter-flow.

For simplicity the spreading members 26 and 84, 92, respectively, have been illustrated in the figures as stationary with escape openings distributing the water over the whole top face area of the contact bodies. It is desirable to supply ample water to ensure perfect rinsing of the layers or sheets of the contact body, although the channels in the body then may be blocked more or less completely by the water, therefore, it is suitable to operate with an intermittent water supply so as to maintain the demand of perfect rinsing without causing the blocking of the channels to become permanent, and at the same time to prevent the body from having time to become dry. In embodiments for use in practice, the pump of the spreading member may operate intermittently and possibly so as to supply water alternately to different sections of the spreading member. Another expedient is to arrange several contact bodies adjacent one another, which intermittently and at various instants are supplied with water. Rotating spreading members or members movable in some other manner meet the same demand.

The lower portion of the contact body may in some cases be made with plane foils or sheets the planes of which coincide with the direction of flow of the gas and which are kept in position by means of spacer members. Each second sheet between the corrugated sheets may be plane, said plane sheet being perforated or having the form of a network to provide openings for the ways of flow of the fluids crossing one another laterally of the corrugated sheets. All sheets may be disposed with their folds extending horizontally in which case, however, particular spacer members become necessary. The folds may have serpentine shape. The fluids may pass through the contact body in the same direction, such as vertically and possibly in a counterstream.

While several more or less specific embodiments of the invention have been shown and described, it is to be understood that is is for purpose of illustration only, and that the invention is not to be limited thereby, but its scope is to be determined by the appended claims.

What I claim is:

1. A gas-liquid contact device comprising: means mounting a plurality of facially-opposed corrugated sheets of material disposed in a substantially vertical, parallel relationship, said material having a surface over which said liquid is readily spreadable, all of the corrugations in each of the sheets being disposed at an angle to the horizontal, and each of the corrugations extending continuously on substantially straight lines from one edge of the sheets to another edge thereof, with the corrugations in alternate sheets crossing the corrugations in the sheets disposed between the alternate sheets, the corrugations adjacent the upper ends of said sheets being open at such upper ends, means to supply liquid into such corrugations at said upper ends, and means to pass a current of gas into the corrugations at one edge of said sheets.
2. A contact device according to claim 1, in which the sheets are composed of asbestos paper.
3. A contact device according to claim 1, wherein the corrugations in the alternate sheets are disposed at an inclination in one direction and the corrugations in the intervening sheets are disposed at an angle in the opposite direction.
4. A contact device according to claim 3, wherein the sheets are united at the apices of their corrugations and at their angular points of crossing.

References Cited by the Examiner

UNITED STATES PATENTS
1,519,739 12/1924 Mark 261—112 X
1,929,411 10/1933 Coey 261—112
1,987,798 1/1935 Ruppricht 161—137 X
2,206,192 12/1944 Spiesman
2,429,265 10/1947 Fleischer 261—97 X
2,971,750 2/1961 Boling 261—140 X
3,155,153 11/1964 Axelsson 165—10

OTHER REFERENCES
German printed application No. 1,058,077, May 27, 1959.

HARRY B. THORNTON, Primary Examiner.
T. R. MILES, Assistant Examiner.