RECYCLING PULP UNDER PRESSURE

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A SECOND GENERATION OF PRESSURIZED FLOTATION CELLS OFFERS DESIGN REFINEMENTS TO IMPROVE PERFORMANCE, EFFICIENCY, AND PULP QUALITY.

MOST DEINKING PLANTS USE FLOTATION CELLS AS the primary method of ink and fiber separation. The introduction of pressurized flotation cells in 1987 provided significant process improvements over traditional atmospheric flotation cells. The newest generation of pressurized flotation cells refines the original process even further.

In both pressurized and atmospheric flotation cells, air is mixed with pulp stock to form bubbles. Ink particles adhere to the forming bubbles, rise, and form a foam layer on the stock's surface to be removed. There the similarities end.

Atmospheric cells are open, operating under normal air pressure. Pressurized cells are sealed. The internal differential pressure of pressurized cells provides a number of advantages, including:

- Improved deinking efficiency by using pressure to maximize ink removal and minimize fiber loss;
- Improved runnability by using a pressurized level control strategy, as well as a pressurized rejects removal system;
- Minimized maintenance because the air intake system does not require the use of venturi devices used by atmospheric cells, which are prone to plugging; and
- Sealed design eliminates potential air pollution problems.

Pressurized cells incorporate features that reduce the fiber reject rate and increase the ink removal efficiency. A key advantage of pressurized cells is lower fiber reject losses.

In most conventional cells, the ink-filled foam is removed by gravity overflow. The cell is designed so that a moving layer of pulp carries the foam over a weir and into a rejects chamber. The reject weir is a channel that diverts froth from the pulp's surface into a reject area. However, this moving pulp layer also contains good fiber that is lost from the cells.

Pressurized cells reduce this high reject rate because the pulp level is below the weir. Pressurized air pushes ink-filled foam out of a reject weir, or outlet, while clean stock flows through an accept valve. A diagram of a pressurized cell is shown in **Fig. 1**.

SECOND-GENERATION PROCESS IMPROVEMENTS

The second generation of pressurized flotation cells offers design refinements that further improve performance, efficiency, and pulp quality. Together, these refinements provide several benefits, including:

- Increased brightness gain;
- Increased ink-speck removal;
- Yield increase through decreased rejects;
- Improved automatic level control; and
- Increased production capacity.

A diagram of this second-generation cell is shown in **Fig. 2**.

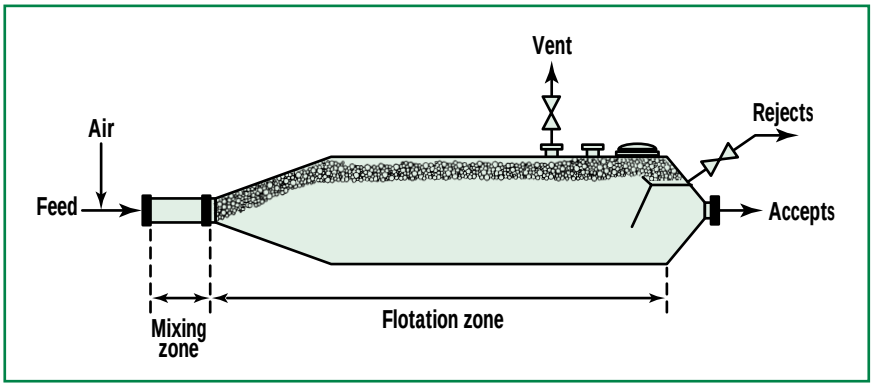
Production increases of greater than one-third have been realized after implementing recent process improvements. In the face of deteriorating furnish quality, these improvements significantly increase production and quality simultaneously, with less rejected fiber.

These refinements include four changes: flow baffles, reject weir, recirculation stream, and level sensor.

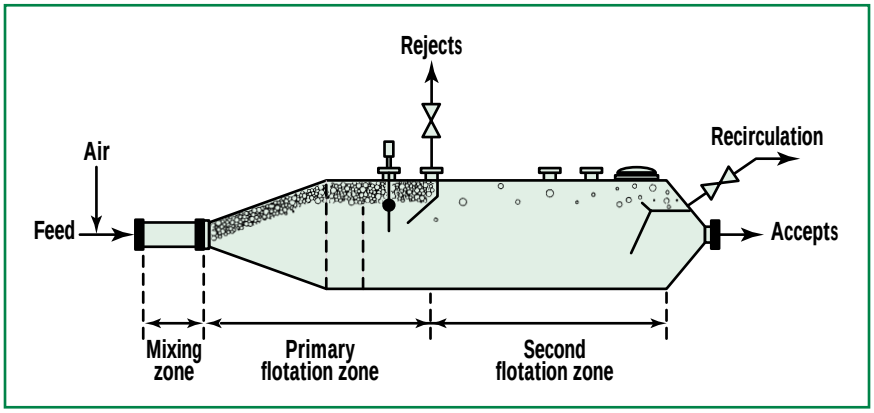
FLOW BAFFLES

Flow baffles are the first refinement to pressurized flotation cells. They have been added near the beginning of the flotation zone.

Pulp surface level control is very important for any flotation process. The level must be optimized in order to separate ink and fiber efficiently. A balanced surface level allows most of the foam to enter the reject weir, while



1. Pressurized deinking module (PDM)



2. Second generation pressurized deinking module (PDM-II)

clean pulp flows out the accept valve. If the level is too high, significant fiber loss occurs through the reject outlet. If too low, ink-contaminated foam escapes through the accept valve.

Air added to stock flowing at 6000-gal/min churns, surges, and generates a tremendous amount of bubbles. Without baffles, waves run the length of the cell and disturb the surface level. Flow baffles stabilize the stock level by preventing back currents and dampening surface waves caused by the rapid rise of bubbles.

This reduction in surface level turbulence also reduces re-entrainment of ink from the froth to the stock. Re-entrainment occurs when bubbles collapse or ink specks sink through the bubble film, causing them to be reintroduced and remixed into the pulp stream.

REJECT WEIR

In the second refinement to the pressurized cells, the reject weir and vent have been combined and moved forward near the middle of the cell.

Ink-rich froth is separated and removed more rapidly by repositioning the reject weir closer to the initial bubble formation. This configuration allows less time for re-entrainment.

Froth is removed by adjusting the reject weir valve opening. The normal operating pressure of the pressurized flotation cell expels the reject foam while the reject control valve is open. In a similar way, the pressure also pushes the recirculation stream out the recirculation valve.

RECIRCULATION STREAM

A third refinement is a small recirculation channel added at the terminal end of the cell.

Bubbles rise at different rates. The large bubbles that are formed in the mixing zone rise more rapidly than smaller bubbles. These smaller bubbles pass under the reject weir to form a fine, denser froth in a second flotation zone. The small recirculation stream at the end of the cell captures this late-forming froth which has escaped the reject weir.

This fine, ink-filled foam is not easily separated from the bulk liquid stock and consequently is rich in useful fiber. The recirculation stream does not go to a secondary treatment cell where added rejects and fiber would be lost. Instead, it is returned to the flotation cell's feed chest for a subsequent pass through the process without fiber loss. It is more efficient to selectively recirculate this ink-enriched stream than directly recirculate the entire flow through one accept valve.

LEVEL SENSOR

The last refinement to pressurized flotation cells is the addition of a stock level sensor. The sensor was placed directly in front of the reject weir. It is used for single-loop, level-control and automatically adjusts the reject valve opening relative to changes in stock level. **TJ**

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