Stifling Those Troublesome Fumes

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There are a number of places in metal finishing shops that can be generators of unacceptable air emissions. One of these that can be solved relatively inexpensively and produce benefits far beyond just eliminating the fumes is the use of a pump-activated eductor system. These systems reduce airborne fume emissions; save heating costs by up to 25 percent; save metal as a result of more uniform brightness and thickness distribution; reduce brightener consumption; and reduce or eliminate gas pitting, and more. There is a significant trend toward these eductorsÑnot only in process tanks, but also in cleaning tanks, pickling tanks and certain rinses.

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Mechanical and air agitation has long been employed in process solutions in the metal finishing industry. Slowly, the experience and word is spreading that there is a better, more efficient way to agitate without the wafting of fumes being experienced with mechanical agitation or the spewing of vapors with air agitation.

In addition to these plating solutions, the benefits that are experienced in fluid agitation of the process solutions are likewise adaptable to cleaners, chromating, anodizing and similar processes.

Mechanical Agitation

Mechanical agitation (figure #1) was first employed in the early 1900's. Started with a canoe paddle and progressed to the device shown in the figure. Horizontal oscillators were generally employed causing a steady, stable agitation. Nevertheless, the motion was sufficient enough to cause fumes to lift from the surface of the agitated tank and contributed to the overall air contamination or load on fume scrubbers. Years ago when foam or "ping pong" balls were widely used to suppress these fumes, they often entrapped hydrogen gas and with a spark from any source (and these were plenty) would explode with tremendous force which didn't bother the platers much, but to the uninitiated, they were notably upset.

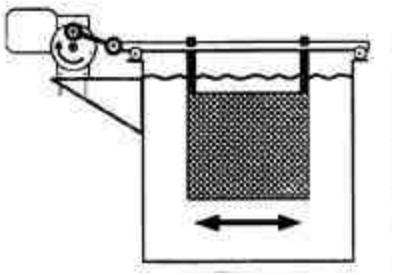

Figure 1

Air Agitation

Air agitation (figure #2) has long been employed supplementing mechanical agitation in many cases. First plant air was used for the applications, but it was found to be expensive to provide a large installation, however, condensation, oil from the air and oxidation (rusting) became a problem, which promoted rejects.

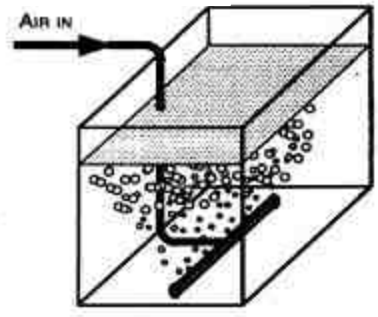

Figure 2

Solution to the oil contamination of solutions problem was resolved by utilizing regenerative blowers in lieu of compressed (plant) air. However, an inordinate number of problems remained. Namely:

- Holes in the sparger pipes are relatively small, which makes them prone to blockage. It is very common to see air agitation solutions with vigorous surface movement in one corner of the tank and static solution in other areas.
- Inability to direct impingement of air on parts in a predictable manner requires over-sizing of the blower.
- Particulate contamination from feed air thought to be clean or filtered.
- Process contamination by vapors in feed air from a variety of sources.
- Increased ventilation/scrubber demand, as released air is contaminated with chemical fumes.
- Higher energy costs on heated tanks due to evaporative losses.

Eductor Agitation

A pump delivers to the piping "tree" at a pressure of from 10 to 30 psig. Figure #3 illustrates the principal of eductor agitation. The nozzles can be positioned on a manifold as shown in figure #4. However, a supplier should create a design for the job, positioning them in either horizontal or vertical positions depending on the nature of the pieces being processed.

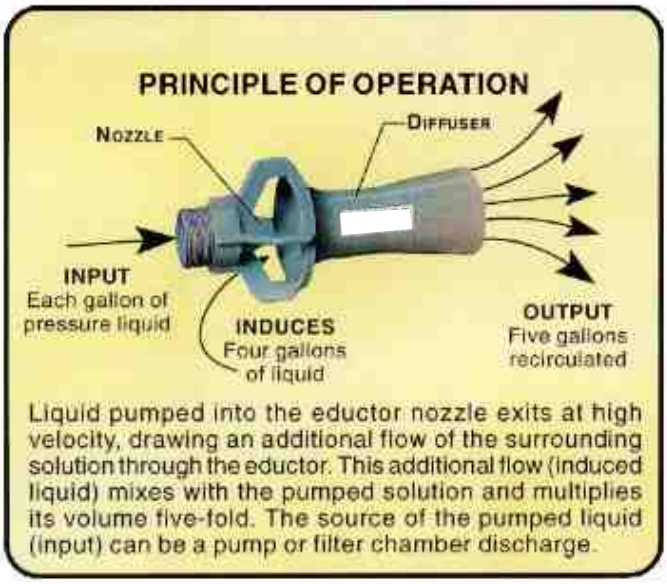

Figure 3

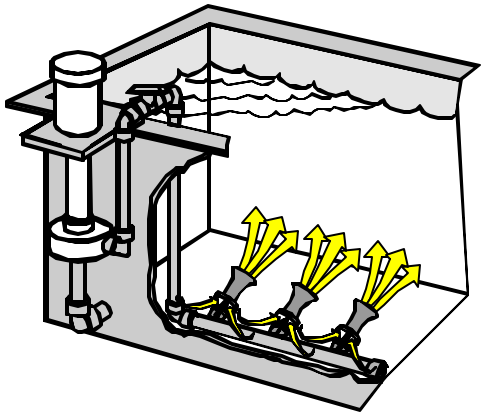

Figure 4

The eductor mechanics are that the "horn" of the eductor is at an 11º angle. A pressure of 10 psi at the nozzle results in a 10 ft. long plume. Every additional 1 psi yields an additional 1 ft. of plume length. The nozzle converts a high pressure, high velocity, low volume flow to a low pressure, low velocity, high volume flow creating a closed loop agitation system. This high flow provides the following benefits:

1. Airborne fume emissions are reduced by 90%.
2. Heat savings of up to 25% are realized.
3. Savings on brightener consumption as much as 20%.
4. More uniform brightness and thickness distribution resulting in metal savings.
5. Permits increased current density, especially compared to rod-agitation – faster plating rate.
6. Considerable improvement in throw and deposit thickness in blind holes and recesses.
7. Large reduction or even elimination of gas pitting.
8. Reduced production of carbonates in alkaline / cyanide processes.
9. Constant agitation.
10. Eliminates temperature stratification and, therefore, achieves faster, more uniform processing.

A 90% decrease in the amount of emissions released! This is a major accomplishment and the theme of the paper as well as one of the suggested topics requested by AESF for the session in Florida. However, it's much more than that as far benefits are concerned if you read in depth the listed 10 benefits above. These benefits are indisputably better than any mechanical or air agitation system. So . . . any plating shop using mechanical agitation or air agitation should

- Consider the application carefully.
- Install an eductor system on one of your process solutions as a test. The system should be designed by a company that specializes in these systems. Do not just buy eductors and place them on manifold trees and size your own pumps. If you don't follow this sequence, you probably will not see the full value of the system.

In summary, eductor agitation improves mixing which increases filtration efficiency, eliminates contaminating vapors and thermal stratification; promotes throw in low-density areas.

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