results. When utilizing these cleaners, the general practice is to eliminate auxiliary scavenging mediums as in most cases the exhausting water, air, or steam is sufficient to carry away the debris. These cleaners are made for the cleaning of tubes as small as $^1/_2$ in. ID. For all practical purposes there are no restrictions to the upper limits, and tubes up to 6 in. ID are commonly cleaned, although not necessarily heat-exchanger tubes.

Conclusions

Experience with mechanical cleaners has indicated that large savings in capital investment, as well as increased process efficiency are attainable. The usual maintenance crew is sufficienty experienced to handle mechanical cleaners which can be procured at a very moderate cost. Consequently many plants have established this method as the preferred one, particularly for immediate "on the spot" service, and also as spare emergency cleaning equipment. Experience also indicates that these cleaners usually perform their task satisfactorily long before other methods are started. For the opening up of completely plugged heat exchangers, mechanical cleaning is the only method available barring retubing. At present there is no known method of pickling, lancing, or otherwise clearing out plugged heat-exchanger tubes.

Since the advent of the specially designed cleaner, manufacturers have noticed consistently an increased interest and demand for its use. It must be presumed that this interest has been aroused because of the feasibility of such a product and method. Unquestionably, as time progresses, the improvement of mechanical cleaners will keep pace with engineering concepts of maximum work output at a minimum invested cost, and in the shortest length of time.

Discussion

F. E. Johnston.[2] Prior to the introduction of the pistol-type hollow-shaft and cutter-bit tube cleaner, we had tried various methods of cleaning badly fouled condenser tubes using varied types and combinations of equipment ranging from twisted square cold-rolled stock hammered out to an arrowhead which was twist-driven into the tube with a hammer and then turned by a pipe wrench to loosen it.

This method was crude and time-consuming, as well as inefficient. The same type rod was next used but propelled by electric drilling machines. This procedure resulted in burned-out equipment, and very tired and disgusted operators, as well as a costly and unsatisfactory job.

Both of the foregoing operations were carried out on a dry basis at long and unscheduled intervals.

Then we procured a pistol-type tube cleaner, using air at 100 psi for driving the drill head. With water as the flushing agent at 70 psi, we were able to speed up operations and obtained a more effective and therefore a more efficient cleaning job.

As pointed out in this paper, no matter how good the available equipment, unless a definite schedule of periodic cleaning is set up and adhered to, tube cleaning will be slow, laborious, and costly.

The technique of the men performing this work is also important. They must be trained thoroughly in the use and care of the equipment and the most effective methods must be employed. An operation of this nature requires patience, skill, and conscientious application to the job at hand.

[2] Bergenfield, N. J.