ARTICLES

VACUUM EVISCERATION

A Modern Method of Cleaning Fish at Sea

By Thomas J. Connors* and Daniel W. Baker**

Modern methods of handling fish are largely absent from the fishing vessels. In New England off-shore fishing, laborious traditional methods of handling fish on board may have been adequate in the past, but under modern standards of efficiency, product quality, and sanitation, greatly improved methods of handling are needed.

One operation in the fish-handling system that requires improvement is the evisceration of fish. The current practice necessitates teams of 3 men--usually, one ripper and two gutters per team. The work is generally done on the deck, which does not always present a clean, safe, work area because fish and offal accumulate underfoot. This inefficient operation is the major factor in determining crew size.

The Bureau of Commercial Fisheries Technological Laboratory at Gloucester, Massachusetts, has developed, as part of an overall automated handling system, a prototype vacuum eviscerator. This paper compares the new with the present system and outlines the advantages of the new system.

THE PRESENT METHOD

The evisceration of fish on board a large off-shore trawler usually requires two 3-man teams, each team composed of a ripper and 2 gutters. The fish taken in a trawl are dumped on deck. The net is put over for the next tow. Then the rippers stand among the fish, in a tiring bent-over position, select fish, and rip open the visceral cavity with a knife. They then toss the fish to the deck outside the checker, where the gutters remove the viscera by hand, throw the fish into a wash box, and drop the offal to the deck. Here the boat's motion and the wet deck result in mixing ripped fish with viscera. Efficiency, cleanliness, and safety are sacrificed under these tiring and dangerous conditions.

The efficiency of this method was measured from films taken on board a commercial trawler during normal fishing operations. Under normal working conditions, about 16 fish (weighing an average of 2.5 lbs.) can be ripped, gutted, and washed in 1 minute. Hence:

$$\frac{16 \text{ fish/min.} \times 60 \text{ min./hr.} \times 2.5 \text{ lbs./fish} = 400 \text{ lbs./hr./man}}{2 \times 3 \text{ men}}$$

VACUUM EVISCERATION

To determine the productivity of the vacuum eviscerator, we made a time study at the Gloucester Laboratory. Figure 1 shows a diagram of a single mechanically operated vacuum pump and tank. Since a number of such stations can be operated from a single pump and tank, the number of stations would be limited primarily by the size of the vessel and crew. This equipment offers flexibility by permitting the combination vacuum tank-trap to be located anywhere on the vessel, so it does not interfere with normal fishing operations. The vacuum evisceration device then can be connected to the central suction head by a flexible hose allowing the catch to be processed where dumped; it eliminates unnecessary handling. This equipment can be adapted to operate with any reserve power a vessel may have.

Figure 2 shows the sequence of operation of the valve linkages. After the operator pushes a fish onto the interchangeable nozzle, shown in Figure 1, he depresses the foot pedal to open the vacuum valve (b), and the vacuum pulls out the viscera, which it then deposits in the vacuum tank-trap. By further depressing the foot pedal, the operator closes the vacuum valve and simultaneously opens the water-flushing valve (c). When water overflows the visceral cavity, he releases the foot pedal part way to position B, closing the flushing valve and opening the vacuum valve, instantaneously removing the flush water.

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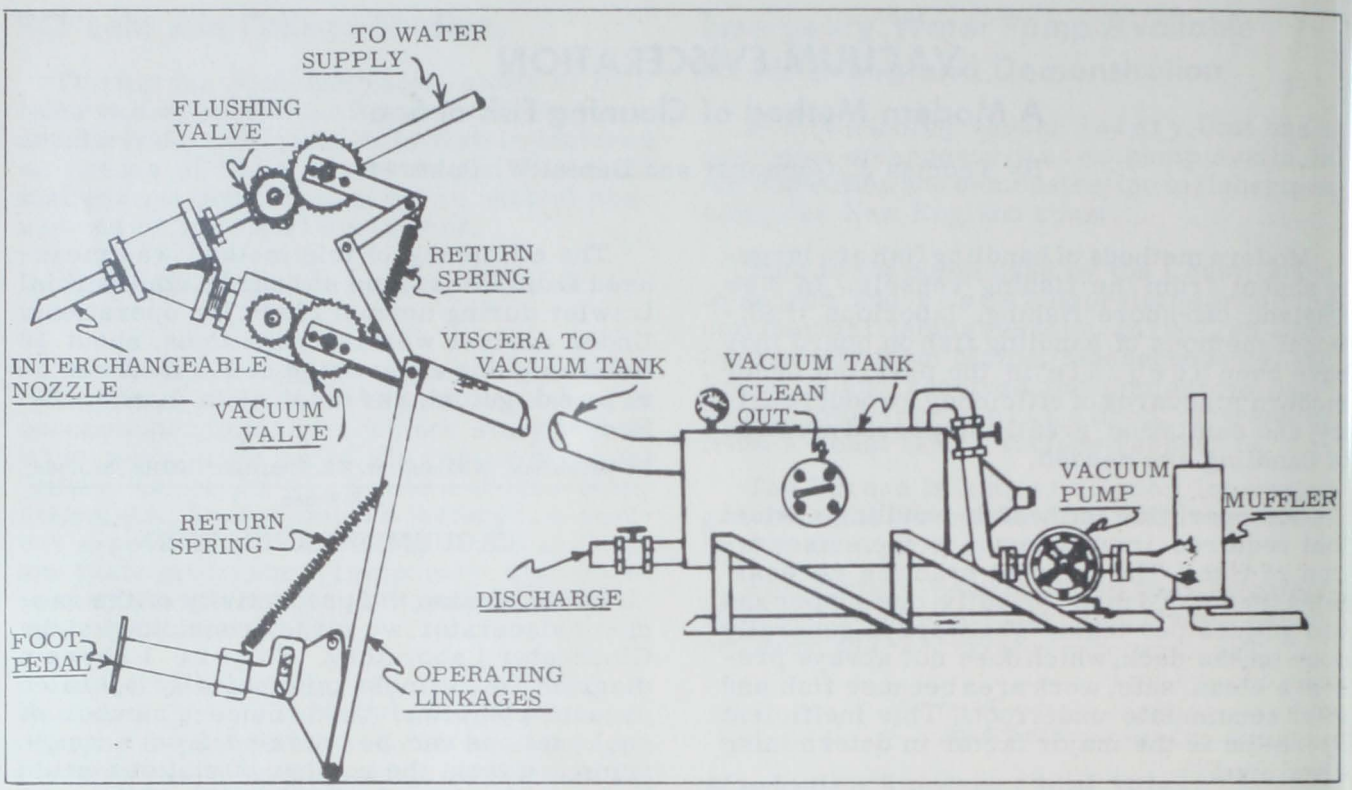
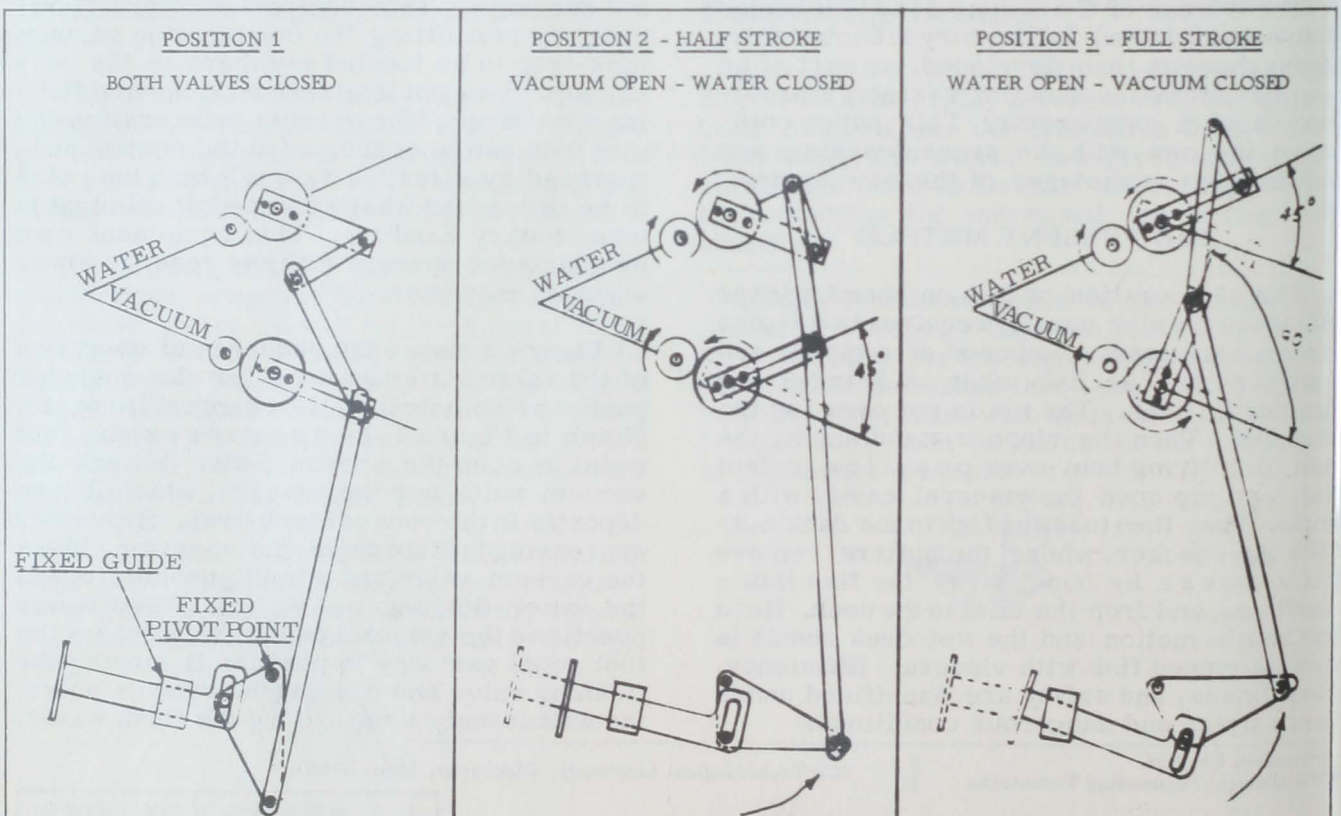


Fig. 1 - Semi-automatic prototype vacuum eviscerator and flushing device for cleaning the visceral cavity of fish.



Valve operation is sequential through operating linkage. Valves are gear operated through ratio of 2 to 1. 45° rotation of large gear rotates small gear 90° for full opening of ball valve.

Fig. 2 - Schematic of linkage for valve operation of vacuum eviscerator.

When he completely releases the foot pedal, he closes the whole system, as in (A), leaving it ready for the next sequence.

At a more advanced stage of development, the entire sequence can be made completely automatic and adapted to the special needs of individual vessels.

In measuring the performance of vacuum evisceration, we found that a fish could be cleaned and flushed in about 10 seconds during continuous operation. Thus, one man can eviscerate and flush:

1 fish/10 sec. X 3,600 sec./hr. X 2.5 lbs./fish = 900 lbs./hr./man

ADVANTAGES OF VACUUM EVISCERATION

Vacuum evisceration and flushing provide these advantages:

1. The crew size of larger vessels can be reduced by 3 men, resulting in more income per man. Also, this mechanization releases to other vessels experienced men, who are in short supply.

2. The equipment can be placed in such a manner that the men can work in a convenient sitting or standing position, instead of a tiring, bent-over, position.

3. Safer working conditions can be provided because no fish or offal would be deposited on deck causing dangerous, slippery footing.

4. Bacterial contamination can be reduced because the fish do not have to be cut. Also important, the visceral contents are effectively removed from the processing area. The quality of fish landed in port should therefore be improved.

5. The landing of higher quality fish can result in economic advantages, which benefit both industry and consumer.

NOTE ON INSTALLATION AND OPERATION

Because of our limited knowledge of the costs of equipment, fabrication, and services, we can only estimate the cost of the vacuum eviscerator. We believe it would be in the order of $5,000. Although the prototype was tested at sea, it has not been used for any extended period. We therefore cannot estimate down times and maintenance costs, but present indications are that these units will be relatively trouble free.

INFLATABLE SKIRTS FOR HOVERCRAFT

An inflatable skirt that allows hovercraft a large area of supporting air cushion when they operate, but needs only a small storage area, has been patented in England.

The invention provides a skirt, held up by inflatable members, that extends laterally from the rigid base of the craft's body and increases the area of the trapped air cushion on which it hovers. With the retractable skirt, hovercraft can be designed with rigid bases small enough to be carried as lifeboats on the deck of larger vessels and yet have air cushions large enough for efficient riding when they operate. (Reprinted with permission from "Science News," weekly summary of current science, copyrighted 1966 by Science Service, Inc.)