Peerless Pump

TECHNICAL INFORMATION BULLETIN

NUMBER TWENTY-EIGHT

Vortex Suppressor

Pumps of the "barrel" or "can" design are widely used to move water, oil, hydrocarbons and other liquids in applications where floor space is limited. These pumps have on occasion presented field problems such as objectionable noise, vibration and impaired inlet flow or hydraulic instability, due to vortexing and poor flow distribution within the barrel.

Vortexing results in a pulsating-flow disturbance, which registers on the pressure gauge. Noise and vibration coincide with gauge fluctuations. Cavitation and damage to the pump, with a corresponding loss of efficiency results. Thrust bearings can be damaged by the alternating load.

At Peerless Pump, a model test program was prepared. The model simulated some typical field installations so that these conditions could be studied. For visual observations, viewing ports were provided in the approach sections and a full range plastic barrel replaced the normal steel barrel.

Performance tests of the pump were run over the complete capacity range. As in the field jobs, fluctuations of the pressure gauge coincided with the noise and vibrations. Viewed through the plastic section it was quite apparent that violent and noisy vortex systems and poor flow patterns passed transversely across the pump's entrance bell. Normal axial flow was momentarily disrupted with each occurrence of a vortex. The disruptions registered as gauge fluctuations. The performance graph shows this as a "break-off" similar to that caused by cavitation (Figure 1).

To confirm these findings the tests were conducted using each of the various barrel shapes in conjunction with the different devices for flow control. Virtually no improvement was noted for any of the barrel shapes or geometric configurations contrived and tested. Figures 2 through 5 show flow patterns for barrels with flat and "dished" bottoms, barrels with a flow cone and guide vanes at the entrance to pump bell as well as to the barrel inlet. Flow lines sometimes changed directions, but the cross-flow vortices and noise persisted.

From these observations it seemed reasonable to try to control the flow by some form of a grid system using the principles of boundary-layer and separation phenomena. Figure 6 illustrates the approaching multi-directional, concentrated high-velocity flow as it impinges on the bars of the grid system where there is an interchange of flow potential and a modest increase in velocity. The dissipation or re-alignment of the energy fields results in a flow more uniform in direction and velocity magnitude. The size of the bar and the mesh were varied to find an optimum for minimum entrance loss and maximum stability of flow.

The device is called a vortex suppressor according to its function. The use of the device on the pump's suction bell (Fig. 7) resulted in vortex-free, quiet and steady performance, which has been confirmed by many field applications. Recommendations for the various prototypes must maintain the model geometry. Patent investigation has been initiated.

Without the vortex suppressor the disturbances were present whether the barrel was long or short, within practical limits, or whether the barrel inlet was above or below the pump bell. The full range of head-capacity within the cavitation limits of the impeller is assured through the use of the vortex suppressor.

The device also has broader use. Some types of flow disturbances in pumps and upstream of flow-measuring devices such as venturis or weirs can be corrected by forms of the vortex suppressors. ■

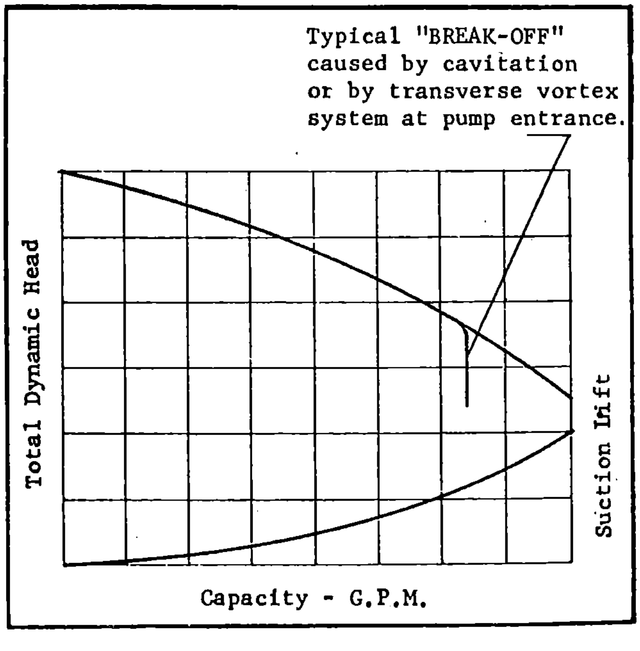

Figure 1. Normal axial flow was momentarily disrupted with each occurence of a vortex. The performance graph shows this as a "break-off" similar to that caused by cavitation.

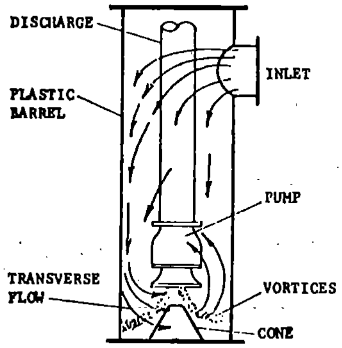

Figure 2. Flow pattern for a barrel with a flat bottom and a flow cone.

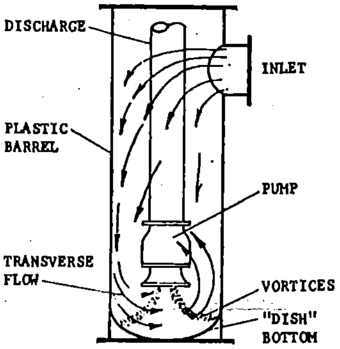

Figure 3. Flow pattern for a barrel with a dished bottom.

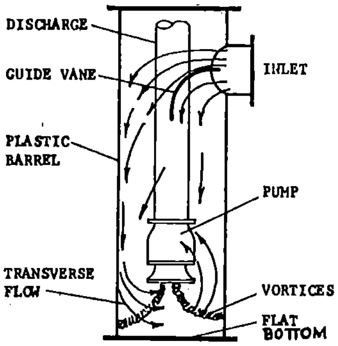

Figure 4. Flow pattern for a barrel with a flat bottom and a guide vane.

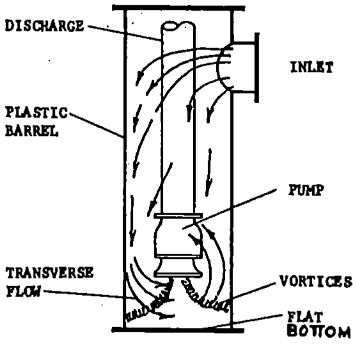

Figure 5. Flow pattern for a barrel with a flat bottom.

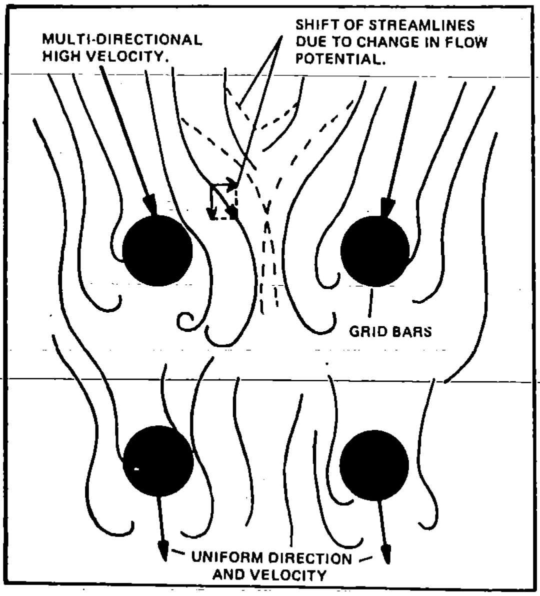

Figure 6. Illustration of the approaching multidirectional, concentrated high-velocity flow as it impinges on the bars of the grid system where there is an interchange of flow potential and a modest increase in velocity.

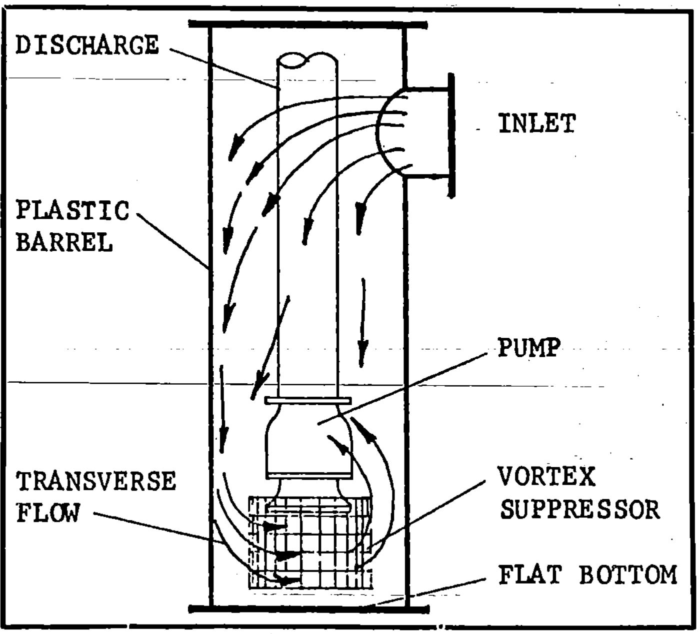

Figure 7. **Use of grid system prevents the occurrence of vortexes in barrel flow pattern.**

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Peerless Pump
A Sterling Company
1200 Sycamore Street, Montebello, California 90640 (213) 726-1232 Telex 67-4156
2005 Northwestern Avenue, Indianapolis, Indiana 46206 (317) 925-9661

3783M 10MPP
PRINTED IN U.S.A.