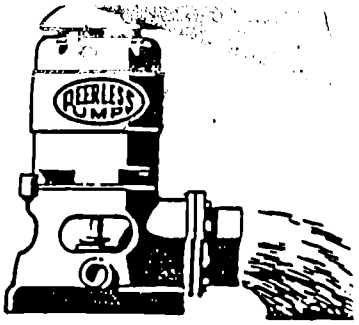
Something about verticals

from Emile Assaf



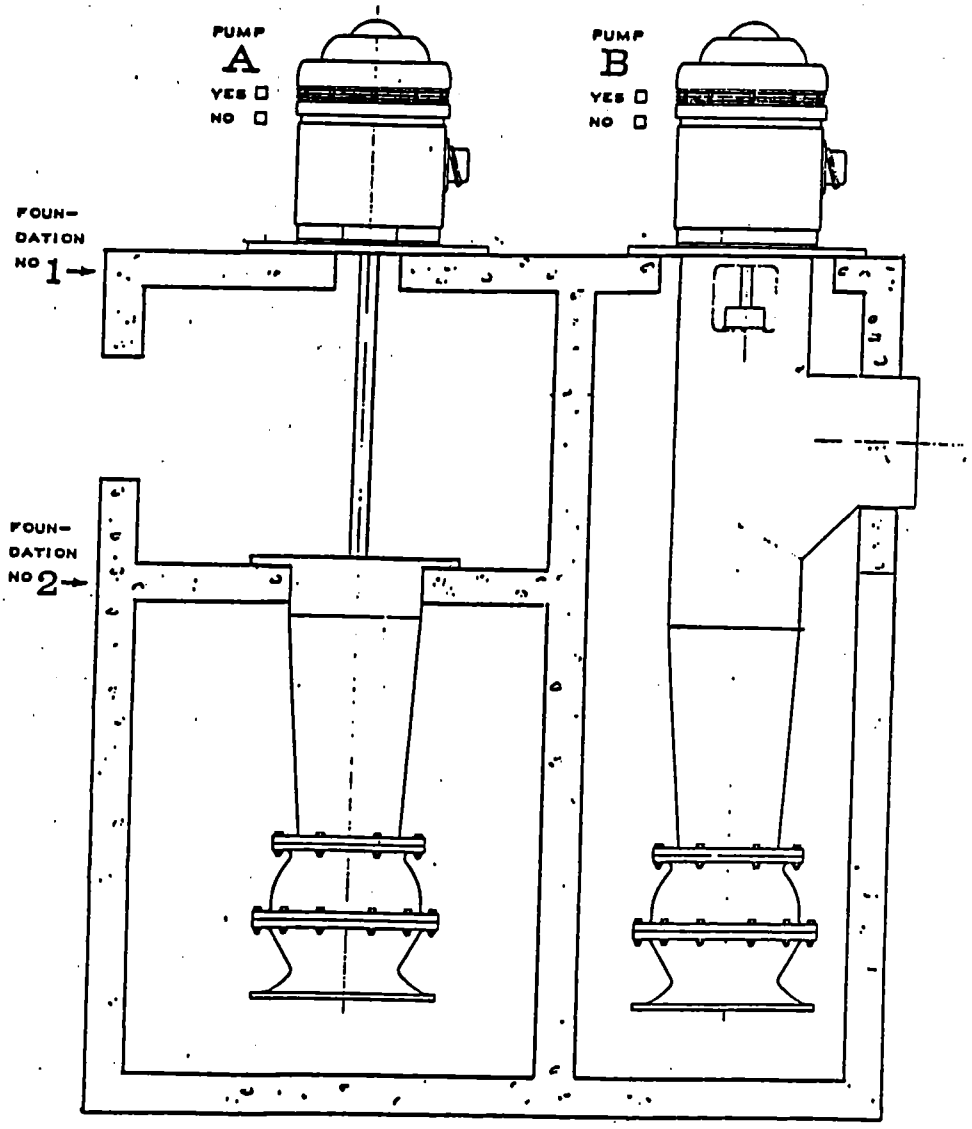
September 25, 1968

DOES THE FOUNDATION upon which the driver is located have to be able to withstand the HYDRAULIC DOWNTHRUST?

This particular point has caused many serious and sometimes bitter arguments. This point has also caused many pump foundations to be over-designed. Perhaps a lack of understanding of these principles has caused other foundations to be under-designed, creating hazards or even failures.

What are the answers to the questions? In the case of pump "B", the answer is No; the foundation does not have to be designed to withstand the hydraulic downthrust developed by the pump. The foundation must, however, withstand the weight of the pump and motor plus the weight of the water in the pump.

For pump "A", the anwer is Yes; the foundation upon which the motor is mounted must be able to withstand the hydraulic thrust. It must also carry the weight of the motor and the rotating assembly. Foundation #2 must carry the weight of the column and bowl plus the weight of the water in the pump.



Why does Foundation #1 have to carry the hydraulic thrust in the case of pump "A" but not in the case of pump "B"?

The reason is relatively simple. In the case of pump "B", the forces resulting from hydraulic downthrust are locked up within the pump itself. However, with pump "A", the column ends at Foundation #2 while the motor is mounted on Foundation #1. Thus, the hydraulic thrust forces are transmitted through the concrete structure, rather than the pump column.

A good example of how this principle works, is to visualize a carriage bolt with a coil spring located between the head of the bolt and the nut. As the nut is tightened and the spring is compressed, additional force is exerted on both the bolt head and nut. The force created is locked up in the carriage bolt-nut-spring device. No other structure is needed to withstand any of the force or thrust because the unit weight has not changed. This is the same principle that exists in pump "B".

Now, let us cut off the head of the bolt. This is much like breaking the column as in pump "A". It is obvious that the force or thrust is no longer locked up in the device. To compress the spring now, some structure external of the device itself must take the force or thrust.