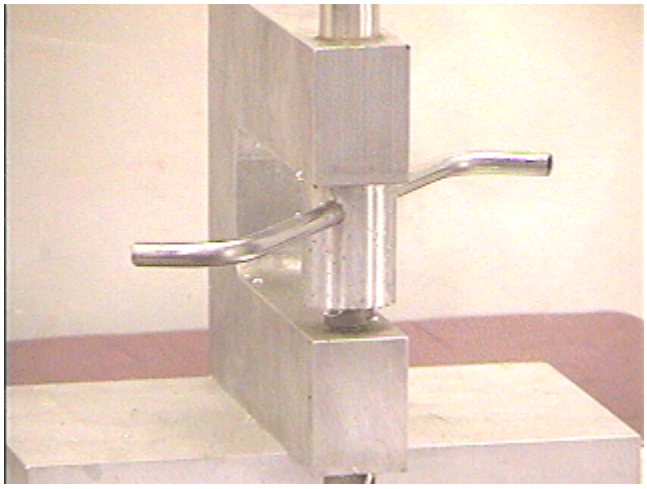
Answer #61

The answer is (b): the sprinkler head will move in the *inverse* direction, as can be seen by clicking on the photograph below.



It is interesting to note that the reaction force that the water exerts on the tube as it is pulled into the nozzle is equal but opposite to the force exerted by the water on the inside of the tube as the water direction turns from azimuthal to radial. These two forces are in the same direction for the "normal" sprinkler so it accelerates very rapidly to its maximum angular speed, but they cancel in the inverse sprinkler mode. As a result the nature of the motion of the nozzle in the inverse mode is rather different, in that it starts almost immediately when the water flow starts and stops almost immediately when the water flow ceases. Although there is general agreement that the inverse sprinkler moves in the inverse direction, the exact nature of the cause of this motion is still under some contention, because of the complexity of the forces involved.

All three of the answers have in fact appeared in the physics literature. An early conference on fluid mechanics suggested that the motion is in the same direction for both the normal and the inverse sprinkler, while an article in one of the physics journals presents the "transport of momentum theorem," that purports to prove that the inverse sprinkler does not move. A number of references can be found in the reference section of the demonstration description link in the main *Physics Question of the Week* list.

Archive 4

Question of the Week

Outreach Index Page

Lecture-Demonstration Home Page

For questions and comments regarding the *Question of the Week* contact Dr. Richard E. Berg by e-mail or using phone number or regular mail address given on the Lecture-Demonstration Home Page.