SweetWater[1]

*"I think I **do** have a better mousetrap."—Sandy Platter*

Sandy Platter put down his drafting pen and watched as the sun set behind the snow-capped mountains that began in the back yard of his Boulder, Colorado, home. It was November 1990, and Platter was working hard to meet a challenge issued by several of his friends on a summer fishing trip in Alaska: Could he design a better portable water filter device than the ones they had struggled to use during the two week trip?

As an engineer with 30 years of experience in the computer peripherals industry, Platter held more than 30 patents and had been responsible for designing products generating more than $2 billion in revenues for several companies. This challenge represented a new area.

Background

In August 1990, Platter and nine friends had gone on a fishing trip in Little Johnstone Bay at the western end of Prince William Sound. The salmon were running, and the group had set up camp near a glacier-fed stream. To get potable water, the group had brought along two portable water filtration devices. Platter had always boiled water on his previous outdoor trips, and he immediately liked the functionality of the devices. Pumping water through a filter was much quicker than waiting around for water to boil and required neither a fire nor a pot dedicated only to providing clean water for drinking. Used with a canteen or ordinary water bottle, the devices could be used while actually hiking or fishing.

But as the trip wore on, the group became increasingly frustrated. The devices were difficult to hold; they took too long to filter enough water for 10 people; and they seemed to clog easily with the fine glacial grit of the stream, increasing the pressure required to pump. Finally, it was difficult for one person to coordinate the inflow and outflow mechanisms with the stream, the pump, and the water bottles used to store the clean water. After each of these sessions, someone inevitably would say to Platter: “Hey, Mr. Engineer, can’t you figure out a better way?”

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[1]The term is commonly used in the arid western United States to describe good drinking water.

Research Associate Thomas D. Everett prepared this case as the basis for class discussion rather than to illustrate either effective or ineffective handling of an administrative situation.

Naturally, Platter contemplated the problem. He took the devices apart, thought about fixing their design, and considered radical changes. When he got back to Boulder, he checked around to see what else was available. Convinced that no well-engineered, ergonomically-designed, portable systems existed, he decided there might be an opportunity in the market.

He ran the idea past his friend Juan Rodriguez, whom he knew from several of his computer peripheral start-ups. Rodriguez, also an engineer, had left IBM to grow several successful high-tech companies, and he was now chairman of Exabyte, a $170 million manufacturer of computer tapedrive backup systems. He also sat on the boards of several other companies and had provided initial financial backing for several ventures in which Platter had been involved.

When Platter visited Rodriguez in October, the intended subject of the discussion was a new tapedrive venture they were considering. Although the venture had promise, both felt it probably had a marginal chance of success. At the end of the meeting, Platter mentioned the portable water filter device idea. Rodriguez was intrigued, saying: "Forget about the tapedrive. You go ahead and put a team together and do this, and I'll supply some seed funding."

Industry Data

The Water Problem

Having an ample supply of safe, clean, and good tasting water had always been essential for avid outdoor recreationalists, but finding a pristine, mountain-fed stream in the middle of the wilderness was no longer a reliable indicator of water quality. In addition to the usual visible hazards like silt that often made water less desirable or non-potable, there were now invisible threats to worry about as well, even in the tops of the Rockies or in remote parts of wilderness and National Park areas.

Although typically associated with developing countries, contamination of drinking water had become more common in the United States since the 1980s. Industrial and commercial development, inadequate waste disposal, and aging municipal water supply systems were all contributing to an increase in the spread of waterborne pathogens which caused a variety of gastro-intestinal illnesses including diarrhea, cramps, and vomiting. In extreme cases, contaminated water led to fatalities. Mountain streams, remote lakes, and ponds were being contaminated by both human and animal carriers, and it was thought that beavers, moose, cattle, and other animals were spreading certain pathogens into most water supplies nationwide.

Micro-biological pathogens were generally classified into three types: bacteria, which included cholera and salmonella; protozoan parasites, such as *giardia* and *cryptosporidium*; and certain viruses, which were relatively rare in the United States. The key distinguishing feature between the types was the size of the pathogen. Bacteria and protozoa typically ranged in size from 20 microns[2] down to 0.2 micron, while viruses were 10 times smaller, ranging from 0.085 micron to about 0.02 micron (**Exhibit 1**).

The Old Solutions

The two most common ways of dealing with these contaminants were boiling the water or treating it chemically with an iodine or chlorine biocide. While effective, each had drawbacks. Boiling required a heat source, took a lot of time, and tied up cooking resources. For backpackers,

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[2]One micron = 10^{-6} meter (a period on this page is about 500 microns).

this could demand significant fuel resources unless wood fires were used. Chemical treatment usually involved iodine, either in tablet form added to a container of water (a practice dating back to GIs and their canteens in World War II), or as an iodinated resin through which the water was pumped. Both biocides left a distinct taste in the water and required time for the chemicals to react with the pathogens. On a larger scale, chlorine was used to treat municipal water supplies. However, certain protozoan parasites including *giardia* and *cryptosporidium* (often referred to as "crypto") were proving resistant to chemical disinfectant.

Micro-filtration

Consequently, a third method was beginning to emerge as the preferred solution: *micro-filtration*, which relied on a physical filter, often made of porous ceramics, to screen out the parasites. Filtration could also remove many of the coarse visible hazards or suspended solids in water, and as such, it represented a promising solution for portable applications.

Two main kinds of filters existed. One was a surface or membrane filter, which relied on precisely sized perforations to block larger particles. The other was a depth filter, which was usually made of a thick porous ceramic material or a packed bed of extremely small particles with a complex structure of channels to trap pathogens.

Squeezing water through fine holes or channels that were of smaller diameter than the pathogens presented a difficult set of technical issues. Pushing water through the filter channels required pressure to overcome the resistance to flow. The smaller the channels, the higher the pressure required or the slower the flow rate through the filter. Too high a pressure and the porous structure could rupture or contaminated water could be forced around the seals between the filter and its container.

Furthermore, the life of a filter was affected by the size of the channels. The smaller the channels, the quicker the filter clogged. The filter then had to be cleaned or replaced. Determining optimal channel size was made more difficult by the wide size range of contaminants that had to be screened out. At one end of the scale were large visible hazards like leaves and twigs; at the other were bacteria measuring as small as 0.2 micron. In between was silt or glacial grit, which could be in a size or concentration range to make the water appear turbid or cloudy and typically measured in the 5 microns to 100 microns range.

In addition, activated charcoal was often used in part of a filtration device to absorb organic molecules and some dissolved chemicals that the filter could not remove, such as pesticides, herbicides, chlorine, and iodine. Like the filter, once the charcoal absorbed its limit, it needed to be replaced.

Outdoor Equipment Market

Outdoor equipment for serious campers, hikers, and climbers was typically sold in specialty retail outlets, and in 1990, the size of this market segment was estimated to be around $875 million. Outlets ranged from a few very large chains such as Recreational Equipment, Inc. (REI), which operated 80 stores nationwide, and Eastern Mountain Sports with 43 stores, to small single-outlet shops like Neptune Engineering in Boulder. The large stores offered a full selection of outdoor equipment and related apparel and accessories and carried all of the leading brands as well as some own-label goods. The smaller shops offered a narrower selection of products, based on a particular specialty (e.g., fishing or climbing) or representing the "best" in a given product category. Salespeople and small-shop owners, often heavy users of the products they sold, were usually quite familiar with the latest technology and trends in the outdoor industry.

Leading consumers were typically backpackers, hikers, climbers, and other avid outdoor recreationalists. As a group, they were young, well-educated, and relatively knowledgeable about the gear they used. Quality was extremely important, and buyers knew which brands had credibility through word-of-mouth and by reading the latest product reviews in various outdoor-oriented magazines and books. Users valued technical prowess and were "turned on" by the latest buzz-words in gear. Many pursued outdoor adventures in exotic or remote locations around the world under extreme conditions. Although they were sensitive to getting good value for their money, buyers could afford to spend significantly on their hobby. It was thought that this group, while tough to please, comprised opinion-leaders who influenced the more casual users of outdoor equipment.

Most equipment manufacturers were small, privately held, entrepreneurial firms. Product designers were moderate to heavy users of their own products and relied on their personal outdoor experience to stay close to customers. As industry economics generally precluded large investments in R&D, firms tended to import technical innovations like new materials or manufacturing processes from other industries to develop new products and improve operations.

Many leading brand manufacturers of outdoor equipment relied on sales representatives ("reps") to sell their products to retail outlets. The rep received 7-8% of sales as commission and was valuable in providing sales support, merchandising expertise, and marketing materials to the retail outlets. Reps were particularly useful for marketing a rapidly changing product line, as dealers often could not keep up with the latest products and extensions of every manufacturer they carried.

Other brands sold through direct mail outlets like L.L. Bean and Cabela's, and a few sold direct to retail outlets, relying on the semi-annual Outdoor Products Shows held in Reno, Nevada, and on advertising in trade magazines to build awareness of their products.

Portable Water Filters

In 1990, the market size of the water filtration systems for backpackers and campers was estimated to be $10 million. Several companies marketed portable water filtration devices, but two models dominated the market: First Need, made by General Ecology, Inc., of Lionville, PA (**Exhibit 2**), and Pocket Filter from Katadyn, whose parent company was based in Zurich, Switzerland (**Exhibit 3**). Both products relied on a filter through which water was pumped via an "up and down" pump handle which moved along the axis of the pump cylinder (much like a simple bicycle or basketball air pump).

First Need had been on the market for many years and was familiar to many consumers and retailers. Suggested retail price was $49.95, but due to a complex network of distributor arrangements and massive discounting to major chains, the actual price ranged anywhere from $38 to $60. Its design relied on a solid block of porous carbon as its filter, which filtered down to 0.4 micron. Replacement filters retailed for $29.95. First Need was not protected by any patents.

Pocket Filter had also been around for many years. It retailed for between $225 and $275, by far the most expensive unit on the market. However, it also enjoyed an excellent reputation for reliability and quality, and many of its users were considered "die-hard loyalists." It relied on a ceramic filter that filtered down to 0.2 micron, was easily cleaned, and lasted a long time. Replacement filters retailed for $130. Although Pocket Filter was not protected by patents, the ceramic filter manufacturing process was proprietary. Katadyn had an excellent customer service record.

Early Design Steps

Platter recruited a friend and fellow engineer, Jeff Aldred, to help with the design. Aldred, who helped found a manufacturing automation company in Boulder, had access to CAD software on his own computer system which they could use to quickly go from concepts to detailed drawings. From detailed drawings they could get prototypes machined from blocks of plastic.

One of Platter and Aldred's first steps was to take apart the existing products on the market to analyze their strengths and weaknesses and consider the possibilities of "reverse engineering." As Platter saw it, the First Need device had two major problems. The first was the ergonomics: it was clumsy and awkward to handle, as he had discovered in Alaska, and its bulkiness, with separate bodies for the pump and filter cartridge, made it difficult to pack.

The second problem involved materials: The body was made of polyvinyl chloride (PVC) plastic, and was not particularly durable. The carbon filter could be cracked easily by impacts typical of rugged use and, once cracked, could not be relied on to deliver safe water.

After talking with a few local outlet dealers, Platter discovered an additional issue involving the marketing of the First Need. Because of the wide range of prices available in the market, consumers had a confused perception of the device's price-to-value ratio.

As Platter looked at Pocket Filter, he could see it, too, had problems. It was heavy and clumsy to use ("One needs three hands to use it"); it did not remove dissolved "tastes" or chemicals as there was no activated carbon in the filter; the filter clogged easily, requiring frequent cleaning to reduce water flow resistance; the intake apparatus was heavy and rested on the bottom of the water source where pathogens were concentrated and muck was thickest; and durability was a concern as the ceramic filter could be cracked with a heavy blow. Probably most importantly, it was too expensive for the average outdoor enthusiast.

After talking with fellow outdoor users of similar products, Platter and Aldred decided on a target retail price point of $40 to $50. But how could they design something that was better in that price range? On what dimensions should it be better?

Immediately, they could see that a redesign of the pump was required to solve the ergonomic problems. Platter also knew that a good filter was going to be crucial to any new design for this type of device. His experience with semiconductors and "ultra clean" applications in the computer industry had given him some familiarity with air filtration technology, and he investigated the possibility of applying such technology to a liquid.

He found a company that could make what he needed in the form of a labyrinth depth-filter made of borosilicate glass fibers. The finely matted fibers could trap materials down to 0.5 micron and, therefore, would remove the major types of waterborne bacteria and protozoa as well as visible contaminants. While achieving filtration characteristics similar to a ceramic filter, it was lighter and less susceptible to breakage. Platter also designed in a layer of activated charcoal to work with the filter to remove additional impurities that affected water taste (**Exhibit 4**).

But there were still a variety of issues to consider in developing a new design, and now, as the sun dropped behind the Rockies, Platter needed to translate what he and Aldred had discovered into a viable design. Picking up the pen, he finished drawing the pump he had started earlier. Even as he did so, however, he knew that once he completed his design, he had to consider how to go forward with it to build a viable business.

Exhibit 1 Water Pathogens

Pathogen	**Size Range (Microns)**
Bacteria and Protozoa	
Entamoeba	3. 5 – 20
Giardia	5 – 12
Cryptosporidium	3 – 8
Campylobacter	0.5 – 8
E. Coli	0.5 – 4
Salmonella	0.5 – 3
Shigella	0.5 – 3
Klebsiella terrigena	0.3 – 5
Cholera	0.2 – 4
Viruses	0.02 – 0.085

Exhibit 2 First Need

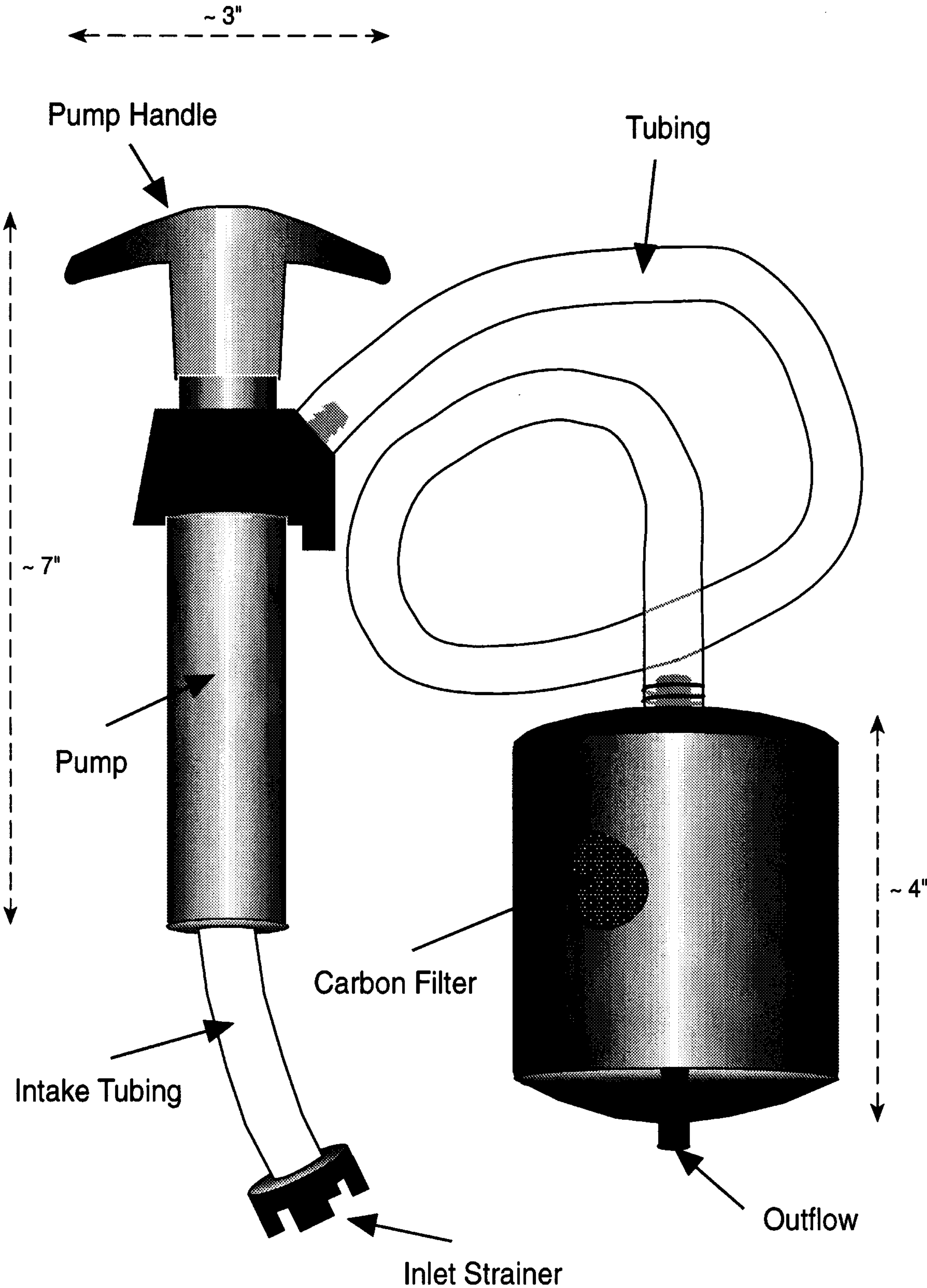

Exhibit 3 Pocket Filter

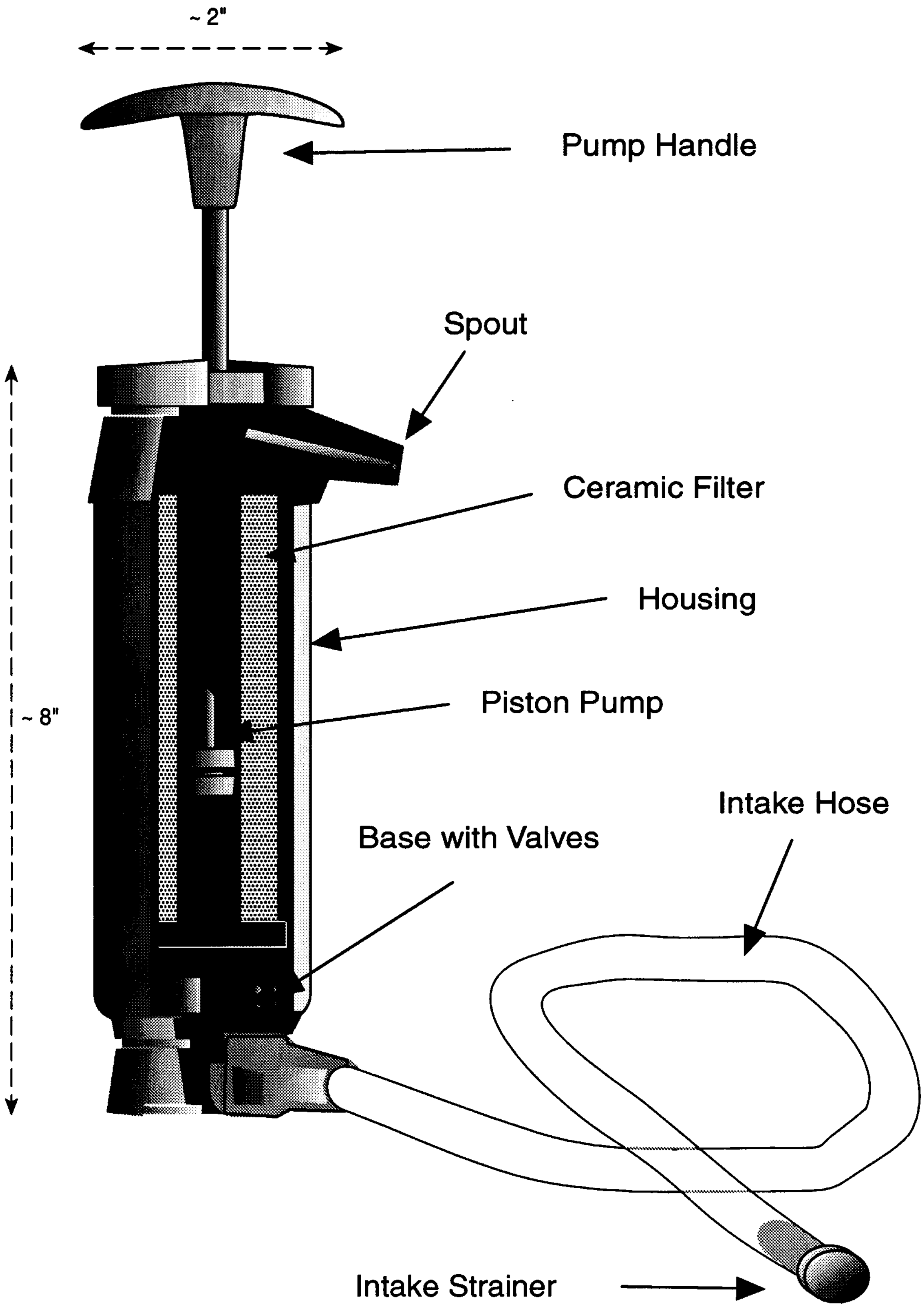

Exhibit 4 Platter's Basic Filter Design