

FRACTION COLLECTOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to the field of liquid collection and containment, and more particularly to a system for sequentially collecting discrete liquid samples in collection tubes.

Fraction collectors are devices intended for collecting liquid samples originating from a slow flowing source, such as a chromatography column, where the composition of the liquid varies over time. Generally, fraction collectors will include a support surface capable of holding a plurality of separate collection tubes and a dispensing head capable of selectively directing the liquid sample to individual collection tubes. In this way, discrete liquid fractions of the sample may be collected in separate tubes for later analysis or use.

Fraction collectors may be broadly categorized into two groups. In the first group, the collection tubes are arranged in a generally rectangular array and the dispensing head is manipulated to selective feed the individual collection tubes. In the second group, the collection tubes are arranged in a spiral pattern and mounted on a generally circular turntable. The turntable is rotated as the dispensing head is moved radially in order to follow the spiral pattern and track the individual collection tubes. The present invention is primarily concerned with this latter group of fraction collectors.

Fraction collectors employing rotatable turntables have proved to be both reliable and economical, but also suffer from several disadvantages. First, most such fraction collectors have inadequate or no provision for disposing of waste liquid (i.e., liquid which is not desired to be collected) flowing from the dispensing head. The most common approach for handling waste streams has been to fill empty collection tubes, but that approach is an inefficient use of the fraction collector's capacity. Moreover, in the case of very large waste volumes, two or more tubes might be required to collect the entire waste. Second, in previous designs, the fraction collector turntables have usually not been enclosed. Thus, liquid which inadvertently misses the intended collection tube will be lost from the system and usually flow or splash onto the laboratory bench. The situation is not only messy, but might even be hazardous under certain circumstances. Third, the turntables in such systems are not always conveniently replaceable. While it would be frequently desirable to remove the turntable with the full complement of collection tubes in place, many systems anticipate that the collection tubes will be transferred individually to a second holding rack. Even in those systems which allow for removal and replacement of the turntable, it is frequently necessary to move the displacement head, which requires careful realignment when the system is placed back in use.

It would therefore be desirable to provide fraction collectors of the rotatable turntable-type which are capable of disposing of incoming waste streams without having to fill collection tubes which might otherwise be used for collecting desired sample fractions. It would be particularly desirable if the fraction collector could handle virtually unlimited volumes of waste, even at very high flow rates. Additionally, it would be desirable if the fraction collector allowed for convenient removal

and replacement of the turntable, with a simplified mechanism for realigning the dispensing head.

2. Description of the Background Art

U.S. Pat. No. 3,004,567, describes a fraction collector comprising an open turntable capable of holding a plurality of tubes in a spiral pattern. The turntable is incrementally rotated by a gear mechanism which mates with a disc having a hole pattern corresponding to the tube pattern. The collector suffers from several drawbacks, including a lack of waste drainage capability, a drain tube support arm which must be realigned every-time the turntable is replaced, and an external drive motor and gear assembly which increases the area occupied by the device. The Cygnet® fraction collector, available from ISCO, Inc., Lincoln, Nebr. 68505, is constructed similarly to the design disclosed in U.S. Pat. No. 3,004,567. U.S. Pat. No. 3,945,412, describes a fraction collector including an enclosed turntable capable of holding a plurality of tubes in a spiral pattern. A drop head is coupled to a cam rail on the bottom of the turntable so that the drop head can track the spirally-arranged tubes as the turntable is rotated. No provision is made for draining waste from the feed source to the turntable. U.S. Pat. No. 4,495,975, describes a fraction collector having a spiral turntable and a pivotable drop head which moves inward as the turntable is rotated. U.S. Pat. No. 4,171,715, describes a fraction collector having a spiral turntable, where the turntable is simultaneously rotated and shifted horizontally to pass tubes past a fixed drop head location.

SUMMARY OF THE INVENTION

According to the present invention, a fraction collector includes a base unit and a rotatable turntable mounted on the base unit, which turntable is capable of holding a plurality of vertical collection tubes arranged in a generally spiral pattern. The turntable is enclosed to form a collection cavity which includes a drain port near at its center of rotation. The top surface of the base unit defines a receptacle which also includes a drain port. Thus, by mounting the turntable over the base unit so that the drain port in the turntable is generally aligned with the drain port in the receptacle, fluid which is directed into the collection cavity will first drain from the turntable to the receptacle and thereafter through the drain port in the receptacle to a sink or other disposal location. In this way, virtually unlimited quantities of intentional or unintentional waste liquids can be disposed.

The turntable of the present invention is designed for easy removal and replacement. Specifically, movement of the dispensing head is limited, usually to a first position over the turntable and a second position not over the turntable. In the first position, the dispensing head is properly aligned with the turntables so that liquid will flow into a desired collection tube at all times. In the second position, the dispensing head is out of the way so that the turntable may be lifted from the base unit and replaced with a fresh turntable. The requirement of replacing the collection tubes one by one is completely eliminated.

In the preferred embodiment, the turntable is mounted on a carriage which is slidably received in the receptacle in the upper surface of the base unit. Movement of the carriage is generally limited to within the receptacle, and the carriage is spring-biased away from the dispensing head. The turntable is driven by a capstan which engages a spiral track on the bottom of the