

July 17, 1956

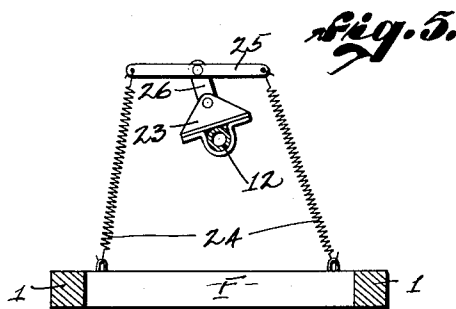
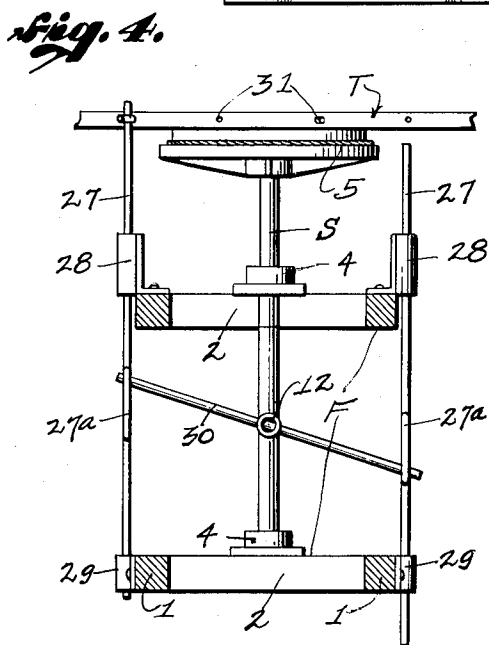
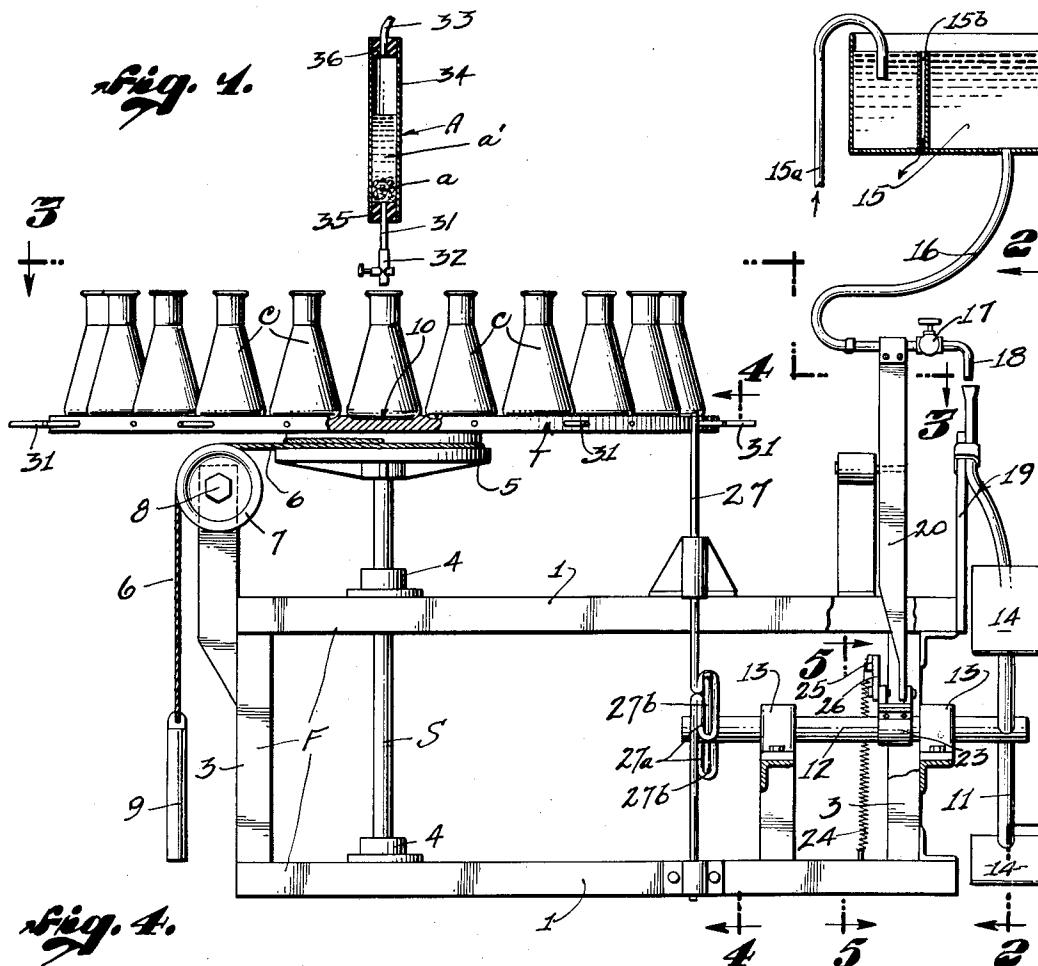
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2,755,008

APPARATUS FOR COLLECTING PRODUCTS OF FRACTIONATION

Filed Aug. 10, 1953

2 Sheets-Sheet 1



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2,755,008

APPARATUS FOR COLLECTING PRODUCTS OF FRACTIONATION

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Application August 10, 1953, Serial No. 373,142

7 Claims. (Cl. 226—96)

This invention relates in general to an art known in the realm of science by the broad term "chromatography" or chromatographic analysis but more specifically practised in industry and the field of chemistry and research as fractionation by means of which certain components of chemical solutions are separated from a parent compound through the instrumentality of the chromatographic column. Although fractionation comprehends distillation in the separation of certain compounds of petroleum and other compounds by heating and volatilization the apparatus of our invention has no relation to a distillation process or apparatus, nor do our present improvements indeed relate to other types of fractionation except as a collector for the products of fractionation, and to such end an important object is to provide a mechanical unit arranged to support and automatically move a plurality of flasks or containers in single file into and from positions beneath a column of a parent fluid in which the separable components to be collected are resident.

Another object is to provide reliable means for utilizing hydrostatic pressure derived from an elevated volume of water which is conducted in alternate charges to oscillating cups mounted on opposite sides of a common fulcrum so that the weight of the water-laden cups will alternately swing a common oscillator between charging and emptying positions and regulate the extent to which the flask supporting table may be rotated under motive power supplied by a gravity actuated weight, or otherwise.

Apparatus for serving the purpose of this invention—at least broadly—has been heretofore used in industry but are too expensive and cumbersome for use in research laboratories and even small industrial plants. Hence, it is an object to provide an inexpensive unit of low initial cost and maintenance requirements which is of simplified structure and mechanical arrangement and capable of operation by the force of gravity instead of by costly and complicated electric motors and attendant devices.

Other and more detailed objects will appear as the description progresses.

We have shown a preferred form of apparatus embodying the invention in the accompanying drawings in which:

Fig. 1 is a side elevational view partly in section;

Fig. 2 is an elevational view of the unit as seen from the plane of line 2—2, of Fig. 1;

Fig. 3 is a top plan view; on line 3—3 of Fig. 1; and

Figs. 4 and 5 are respectively, sectional elevations on lines 4—4 and 5—5 of Fig. 1.

As shown, the unit includes a suitable supporting frame F with horizontal member 1, 1 extended longitudinally, transverse members 2, 2 and upright members 3, 3 so framed and joined as to provide maximum rigidity. A rotatable table or platform T is supported on frame F by means of a vertical shaft 5 which revolves in bearings 4, 4 secured to upper and lower members of the frame.

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Table T has a pulley 5 at its bottom and affixed to shafts to which one end of a cable 6 is secured. Said cable runs over an idler pulley 7 mounted on the frame on a stool 8 and a weight 9 is secured to the free end of cable 6. Thus, the force of gravity applied to pulley 5 tends to rotate pulley 5 and table T at least throughout one complete revolution of the table but intermittently in step-by-step movements under control of an escapement mechanism to be hereinafter described. The upper side of table T has a plurality of depressions 10 therein at uniformly spaced points for holding flasks or containers C in fixed positions on the table in a circle concentric with the table or otherwise but in any case so that as the table is fractionally rotated the flasks will be advanced in sequence to the same position beneath a separator column A adapted to contain a compound from which the compounds are dispensed in a gradual process into the flasks C, one after another in succession.

While power for rotating table T is derived from weight 9, the escapement mechanism which regulates rotation of the table and times the successive movement of flasks C to charging position beneath column A is actuated by a simple water motor shown in Fig. 1 and including a bar 11 oscillatably mounted on frame F on a shaft 12 in spaced bearings 13, 13 and having similar water receiving cups 14 at opposite ends of the bar and equidistant from the axis of shaft 12. Preferably cups 14 are of the same form, size and capacity so as to hold equal quantities of water and the depth of the cups is gradually increased from their inner to their outer margins. Water is fed to cups 14 alternately as bar 11 is oscillated, from an elevated tank 15, through a tube 16, a needle valve 17, a spout 18 and separate filling tubes 19, 19 which have their upper ends bend to adjacent positions below spout 18. Said spout is shiftable to alternate positions over the inlets to tubes 19, 19 by means of a bar 20 which is pivoted on frame F at 21 and has its upper end affixed to spout 18 and its lower end hinged at 22 to a collar 23 on shaft 12. Hence, as the leftmost cup 14 (Fig. 2) is swung upwardly with shaft 12 and the rightmost cup swung downwardly, and vice versa, the spout 18 will be swung into position over the tube 19 associated with the raised cup while the water will be discharged from the downmost cup. The member 23 is tensioned as by means of a pair of tension springs 24, 24 secured at their upper ends to opposite ends of a bar 25 which is linked at 26 to member 23, while the lower ends of springs 24 are anchored to the base of frame F as shown in Fig. 5. Thus, as shaft 12 and cups 14 are oscillated in opposite directions the springs 24 urged them to an opposite extreme of movement.

Rotation of table T is arrested and limited each time a cup 14 is raised to charging position, by one of a pair of vertical stop rods 27, 27 which are slidable in spaced guides 28 and 29 on the frame. Said rods 27 have similar loops 27a, 27a with elongated openings 27b, 27b therein through which opposite end portions of a rod 30 extends. Rod 30 is affixed at an intermediate point to and is oscillated by shaft 12 and the rod 30 alternately raises and lowers rods 27 into the path of radial pins 31 borne by and extended from the edge of table T in line with each flask seat 10. As the table is moved a flask C is positioned below column A all of an accumulated component as at a in Fig. 1 has been precipitated from the solution a' and discharged through an outlet 31 under control of a valve 32, or at least until valve 32 is closed by an attendant but in every case until a cup 14 has been filled with water from tank 15 and overbalances shaft

12 so as to rotate said shaft and release the stop rod 27 which up to that point had restrained the table from further operation. Other operations may follow for moving successive flasks to filling position with the same or a different separable components *a* and the compound fluid *a'* vary and their rate of precipitation, settling and flow varies from a very slow drip upwardly, due to inherent properties and both physical and chemical characteristics. All components *a* as well as the compound *a'* are introduced to column A through an inlet 33. Column A may have a body 34 of glass or other suitable material with inserted end closures 35 and 36 bearing the outlet 31 and inlet 33, respectively.

Water is delivered to tank 15 through a pipe 15a and a level of water is maintained in the tank by means of an overflow pipe 15b. Needle valve 17 controls flow of water by gravity from spout 18 into tubes 19 and discharge of water in proper volume into cups 14 of oscillator 11.

Essentially, therefore, this invention comprehends the provision of an automatically operable apparatus which includes a platform or table arranged to support a plurality of flasks in fixed position for intermittent and successive movement to a common position whereat they may be filled in whole or in part with components of a compound solution from a relatively elevated container, a suitable means for moving the table and flasks, and a water driven mechanism for timing the movement of the platform or table, whereby the components of a solution may be separately collected in different flasks at a minimum cost and in a continuing operation.

We claim:

1. An apparatus for collecting fractions from compounds comprising: a frame, a table rotatably mounted thereon, means constantly urging unidirectional rotation of said table, a container supported in fixed position above a plurality of flasks borne by said table and adapted to hold a column of liquid, a water motor including a receptacle for holding a static volume of water, and an oscillator having cups equidistant from its axis, means for alternately discharging water from said receptacle into said cups as said oscillator is reversely swung on its axis, stop devices on said table corresponding in position to the flasks on the table, and means movable on said frame operatively connected with said oscillator for movement into engagement with said stop devices as the table is fractionally rotated to place a flask in position below said container in timed relation to said oscillator, whereby different components of the liquid in said container may be discharged into separate flasks as the table is successively rotated.

2. An apparatus as set forth in claim 1 wherein said means for alternately discharging water includes a discharge pipe leading from said water receptacle to a point of discharge, separate conduits having inlets adjacent said point of water discharge and outlets disposed above said cups when the cups are at their uppermost positions, and a connection to said oscillator for shifting said discharge pipe to alternately discharge water into said cups and thereby effect oscillation of said oscillator.

3. An apparatus as set forth in claim 1 wherein said means for alternately discharging water includes a discharge pipe leading from said water receptacle to a point of discharge, separate conduits having inlets disposed adjacent said point of water discharge and outlets disposed above said cups when the cups are at their uppermost positions, and a connection to said oscillator for rocking said discharge pipe about its axis to alternately distribute water to said conduits.

4. An apparatus for collecting fractions from compounds comprising: a frame, a table rotatably mounted thereon, means constantly urging unidirectional rotation of said table, a container supported in fixed position above a plurality of flasks borne by said table and adapted to hold a column of liquid, a water motor including a recep-

tacle for holding a static volume of water, and an oscillator having cups equidistant from its axis, means for alternately discharging water from said receptacle into said cups as said oscillator is reversely swung on its axis, stop devices on said table corresponding in position to the flasks on the table, and means movable on said frame operatively connected with said oscillator for movement into engagement with said stop devices as the table is fractionally rotated to place a flask in position below said container in timed relation to said oscillator, whereby different components of the liquid in said container may be discharged into separate flasks as the table is successively rotated, said movable means including a bar co-oscillatable with and by said oscillator, said bar having retaining means at its opposite ends engageable with said stop devices to time the fractional rotation of the table with the movement of said oscillator.

5. An apparatus for collecting fractions from compounds comprising: a frame, a table rotatably mounted thereon, means constantly urging unidirectional rotation of said table, a container supported in fixed position above a plurality of flasks borne by said table and adapted to hold a column of liquid, a water motor including a receptacle for holding a static volume of water and an oscillator having cups equidistant from its axis, means for alternately discharging water from said receptacle into said cups as said oscillator is reversely swung on its axis, stop devices on said table corresponding in position to the flasks on the table, and means movable on said frame operatively connected with said oscillator for movement into engagement with said stop devices as the table is fractionally rotated to place a flask in position below said container in timed relation to said oscillator, whereby different components of the liquid in said container may be discharged into separate flasks as the table is successively rotated, and means for supplying desired elements to and for discharging the same from said container into said flasks.

6. An apparatus for collecting fractions from compounds comprising: a frame, an upright shaft journaled thereon, a table secured to the upper end of said shaft, a pulley on said shaft below said table, means for rotating said pulley, means on said table for supporting a plurality of flasks in uniformly spaced positions on said table, a container supported above said flasks at a fixed point for holding a liquid from which fractions may be discharged selectively into said flasks as the table is fractionally rotated to position successive flasks under an outlet to said container, stop devices borne by and extended from the flask position on said table and co-operating stops movable on said frame at timed intervals, an oscillator rockably supported on said frame and having cups equidistant from its axis, a receptacle for water, a discharge pipe leading from said receptacle to a point of alternate discharge into said cups and having a discharge spout at said point, a pair of oppositely extended conduits having inlets adjacent said point of discharge and outlets above the uppermost positions of said cups, means operatively connecting said oscillator with and for shifting said spout to alternate positions above said conduits, and means operatively connecting said slidable stop devices with said oscillator for stopping rotation of said table at regularly timed intervals as the contents of said container are discharged into said flasks in succession.

7. An apparatus for collecting fractions from compounds comprising: a container stationarily supported for holding a column of liquid containing fractions to be collected, a table movably supported below said container and arranged to hold a plurality of flasks in uniformly spaced positions for successive movement to a common position below an outlet of said container, means drivably connected with said table for moving the table and flasks in a given direction and plane beneath said container, and a separately actuated mechanism for

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arresting movement of said table at uniformly timed intervals while the flasks are receiving fractions from said container, said arresting mechanism including an oscillator having cups supported at opposite sides of its axis and co-operating stop devices associated with said table and with said oscillator, an elevated water tank having a spout for controlling discharge of water from said tank, a pair of spaced tubes having inlets disposed in a plane below said spout means controlled by said oscillator for alternately shifting said spout to positions over the inlets at times

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when said cups are moved into positions below outlets to said tubes, thereby alternatively weighting said cups to the overbalancing of the oscillator in opposite directions.

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