March 27, 1956 B. P. McKAY ET AL 2,740,081

MOTOR DRIVEN AUTOMATIC SAMPLE COLLECTOR

Filed Nov. 19, 1951 2 Sheets-Sheet 1

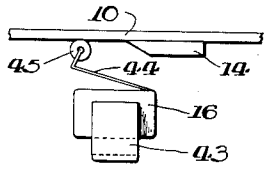


Fig. 5.

Fig. 1.

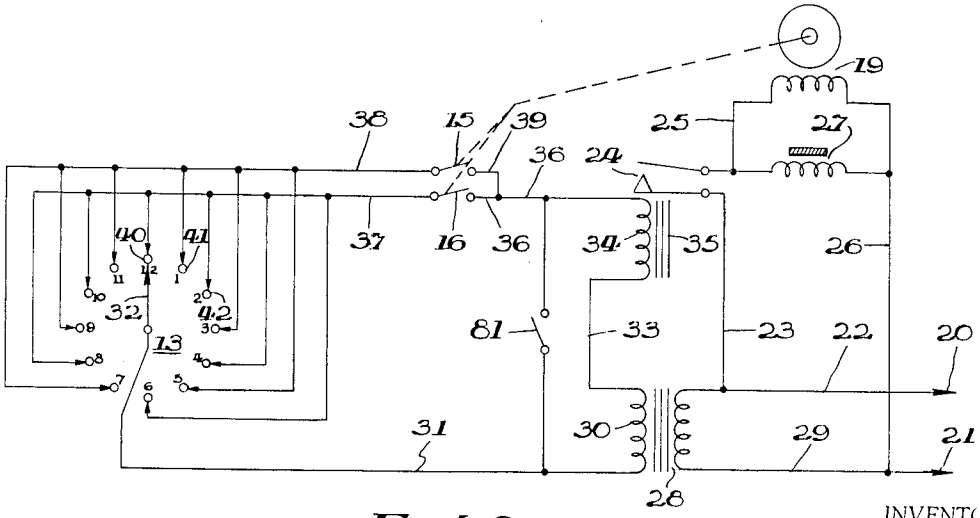


Fig. 2.

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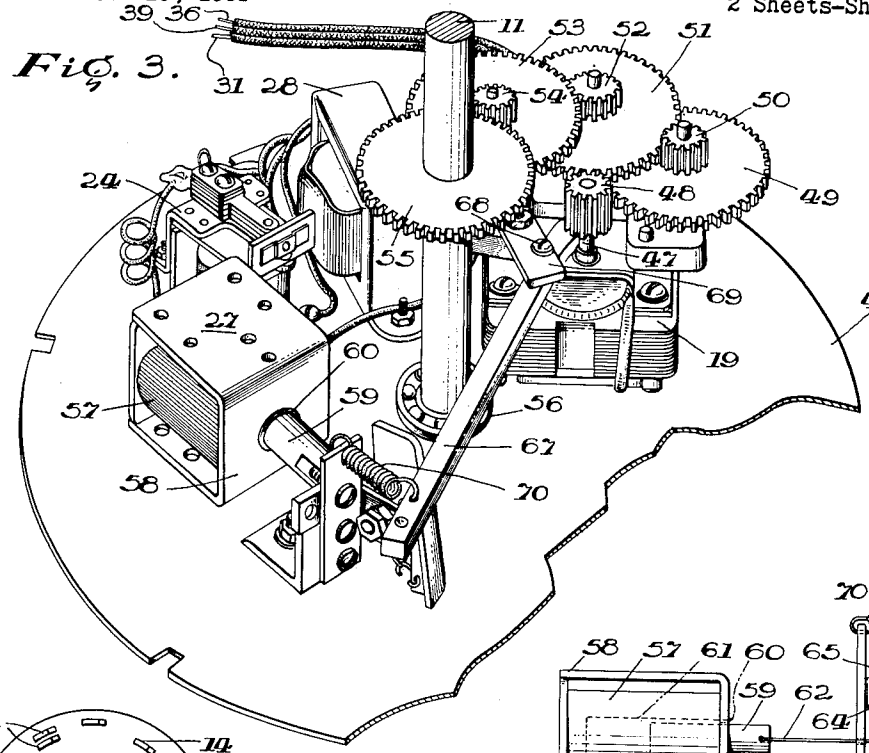
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Fig. 3.



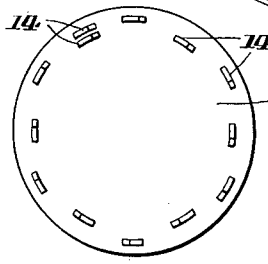


Fig. 4.

Fig. 6.

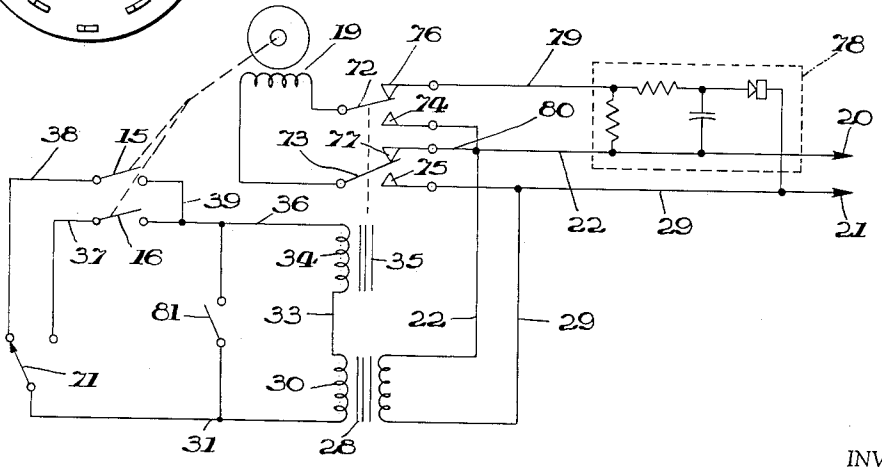


Fig. 7.

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MOTOR DRIVEN AUTOMATIC SAMPLE COLLECTOR

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4 Claims. (Cl. 318—443)

This invention relates to automatic sample collectors and more particularly to such collectors which are actuated electrically by timing mechanisms.

Still further, this invention relates to automatic sample collectors in which the time interval during which the samples are collected may be easily varied as desired so that samples may be collected at equal intervals, unequal intervals, or in various combinations of timed intervals.

Further still, this invention relates to automatic sample collectors in which various sized containers may be employed to receive the samples collected.

Heretofore various sample collectors have been proposed but all of these suffer from one or more disadvantages, it usually being impossible to use various time intervals during which the samples are collected or to collect samples in containers of various sizes.

By the present invention a novel automatic sample collector is provided which overcomes all of the difficulties heretofore inherent in known sample collectors and which provides various advantages for the first time which will appear more fully hereinafter from the description of the invention.

Accordingly it is among the objects of the present invention to provide an automatic sample collector for sampling techniques in the fields of chemistry, biology, nutrition, physics, food testing and preparation, and the like in which the change action is initiated by time and in which fractional portions of a large volume to be sampled may be collected in varying amounts in various sized containers.

It is also an object of the present invention to provide such an automatic sample collector in which the change action may also be initiated by the temperature of the collected samples, by the volume of the collected samples, or by other conditions of the collected samples as will more fully appear hereinafter.

Sample collectors in accordance with the present invention are capable of various mechanical embodiments, one of which is shown in the accompanying drawings, and various electrical circuits may be employed for energizing the motive power of the sample collector, two of which are shown in the accompanying drawings. Consequently the embodiments shown in the drawings should in no way be construed as defining or limiting this invention and reference should be had to the appended claims to determine the scope of the invention.

In the accompanying drawings, in which like reference characters indicate like parts, Fig. 1 is an elevation of an illustrative embodiment of the automatic sample collector of the present invention to show generally the relative position of the several elements thereof;

Fig. 2 is a circuit diagram of a suitable circuit for use with the embodiment of Fig. 1 to energize the driving motor thereof at timed intervals;

Fig. 3 is a view of the driving motor and its associated elements including a solenoid actuated brake, transformer, solenoid actuated control switch and gear train for the turntable spindle;

Fig. 4 is a view in reduced size of the underside of the turntable;

Fig. 5 is a side view of one of the switches energized by the rotation of the turntable for breaking the circuit to the driving motor;

Fig. 6 is a side view of a portion of the solenoid braking mechanism; and

Fig. 7 is a circuit diagram of another circuit suitable for use with the sample collector of the present invention in which braking of the electric driving motor is electrically accomplished.

Referring now more particularly to Fig. 1, an illustrative embodiment of an automatic sample collector of the present invention is there shown in which a turntable **10** is mounted for rotation upon spindle **11** which is driven by an electric motor mounted within housing **12**. A clock timing mechanism **13** is provided to energize at selected intervals a suitable circuit connected to the motor in housing **12**, as will more fully appear hereinafter in connection with the discussion of Fig. 2. Mounted on the underside of turntable **10** are a plurality of spaced blocks **14** which may be arranged in desired positions to actuate switches **15** and **16** to break the circuit to the driving motor as will more fully appear hereinafter.

Various sized containers **17** are mounted upon turntable **10** to receive samples of a larger volume of fluid from any suitable source, generally indicated at **18**.

Turntable **10** is rotated by a suitable electric motor **19** (Fig. 2) contained within housing **12**. Motor **19** is energized from a suitable source of alternating electrical energy, here generally indicated at **20** and **21**. Source **20** is connected to motor **19** through wires **22** and **23**, solenoid actuated switch **24**, and wire **25** and the return circuit to source **21** is made through wire **26**. A solenoid actuated brake releasing mechanism is connected across wires **25** and **26** and is generally indicated at **27**.

The primary windings of a transformer **28** are connected across wires **22** and **29**. The secondary windings **30** of transformer **28** are connected on one side through wire **31** with the moving contact **32** of timing mechanism **13** and the other side of secondary windings **30** is connected through wire **33** with the coil **34** of the solenoid **35** which actuates switch **24**. The other side of coil **34** is connected by wire **36** with one side of switch **16** and the other side of switch **16** is connected to bus wire **37**. A second bus wire **38** is connected to one side of switch **15** and the other side of switch **15** is connected through wire **39** to wire **36**.

Timing mechanism **13** in the embodiment of Figs. 1 and 2 is made from a clock mechanism in which electrical contacts are placed at intervals about the face of the clock and the minute hand is utilized as the moving electrical contact **32** to close electrical circuits through the spaced contacts. The contacts arranged around the face of the timing mechanism are alternately connected to bus wires **37** and **38** and as here shown contact **40** at twelve o'clock is connected to bus wire **37**, contact **41** at one o'clock is connected to bus wire **38**, contact **42** at two o'clock is connected to bus wire **37**, and so on throughout the several contacts. It is apparent that these contacts need not be spaced at regular intervals but may be spaced at any desired regular or irregular sequence of time intervals as may be desired for collection of samples.

Further, it is also apparent that blocks **14** may be spaced about the underside of table **10** to actuate switches **15** and **16** at intervals as may be desired to deenergize the driving motor **19** to bring various sized containers **17** beneath the source of fluid to be sampled.

Assume now that the moving contact **32** has just made electrical contact with contact **40**. Since switches **15** and **16** are normally closed a circuit is completed through bus wire **37**, switch **16**, coil **34**, wire **33**, the sec-

ondary 30 of transformer 28, wire 31 and contacts 32 and 40. Coil 34 of solenoid 35 is then energized and closes switch 24. Switch 24 is closed and electrical energy from sources 20 and 21 is supplied to motor 19 through wires 29, 27, 23, switch 24, wire 25, and wire 26. Motor 19 is then energized and rotates table 10 through spindle 11. At the same time that motor 19 is energized the solenoid actuated brake release mechanism 27 is energized and releases the brake on motor 19 as will more fully appear hereinafter.

Motor 19 continues to rotate table 10 until one of the blocks 14 engages switch 16 and opens it. At this moment the next sample container 17 is brought beneath the source 18 of material to be sampled. Opening of switch 16 breaks the circuit to solenoid 34 and allows switch 24 to open. Opening of switch 24 breaks the motor circuit and deenergizes motor 19 and at the same time deenergizes the solenoid of the brake release actuating mechanism 27. Deenergization of the brake release actuating mechanism 27 allows the brake to be applied to motor 19, as will more fully appear hereinafter, and the movement of the turntable 10 is immediately stopped.

Opening of switch 16 has no influence upon switch 15 which remains closed. In the meantime movable contact 32 is driven by the timing mechanism 13 until it comes into contact with the next contact, contact 41. An electrical circuit is then closed through bus wire 38, switch 15, solenoid 35, wire 33, the secondary 30 of transformer 28 and wire 31. This energizes solenoid 35 and closes switch 24. Closure of switch 24 again releases the solenoid actuated brake release mechanism 27 and energizes motor 19 to rotate table 10 until the next block 14 opens switch 15 to deenergize the electric motor 19 and deenergize the solenoid braking mechanism 27. In the meantime the block 14 which had opened switch 16 has moved away from switch 16 and has permitted switch 16 to close. Thereafter when moving contact 32 engages contact 42 the circuit through bus wire 37 and switch 16 will be completed to again energize the motor 19 and solenoid actuated brake mechanism 27.

It will therefore be seen that parallel circuits are provided to which the moving contact of the timing mechanism is alternatly connected and which are alternately completed to energize the driving motor 19 at predetermined intervals to collect controlled volumes of samples in containers 17. The positions of blocks 14 opening switches 15 and 16 determine the amount of rotation given table 10 so that various sized containers 17 may be utilized as desired for the collection of samples.

Referring now to Fig. 4, a pair of blocks 14 are arranged in side-by-side relationship to open both switches 15 and 16 after turntable 10 has made one complete revolution and all of the containers 17 have received samples. After both switches 15 and 16 have been opened turntable 10 must be rotated to disengage blocks 14 from switches 15 and 16 to start the sample taking cycle and this may be done by closing a suitable push switch 81 connected across wires 31 and 36.

Switches 15 and 16, as shown in more detail in Fig. 5, may be of any suitable type and are mounted in bracket 43 secured to housing 12. Each switch 15 and 16 is provided with an actuating arm 44 terminating in a roller 45 and rollers 45 are engaged and depressed by blocks 14 to open switches 15 and 16.

The various elements mounted within the housing 12 are shown in Fig. 3. These elements are mounted upon a suitable base plate 46 and are electrically interconnected as described with reference to Fig. 2. Motor 19, which may be a shaded pole induction motor rotating at 3600 R. P. M., is suitably secured to base plate 46 and drives rotor shaft 47. Shaft 47 drives small gear 48 which in turn drives large gear 49. Gear 49 drives small gear 50 which in turn drives large gear 51. Large gear 51 drives small gear 52 and small gear 52 drives large gear 53. Large gear 53 drives small gear 54 which in turn drives large gear 55 mounted on spindle 11. These various gears are suitably selected to give turntable 10 the desired speed of 3 R. P. M. A bearing 56 is provided in base plate 46 to receive the lower end of spindle 11.

Transformer 28, solenoid actuated switch 24 and solenoid actuated brake release mechanism 27 are also mounted on base plate 46 and are electrically connected as described with respect to Fig. 2.

The solenoid actuated brake release mechanism generally indicated at 27 comprises a solenoid 57 mounted in a suitable frame 58. A suitable plunger 59 passes through an aperture 60 in frame 58 and is reciprocated within the axial chamber 61 of the solenoid coil 57 (Fig. 6). A resilient element 62 is connected to plunger 59 and is connected at its other end to vertically disposed lever 63. Lever 63 is mounted for rotation upon pivot 64 which is supported by arm 65. Arm 65 is mounted upon upright 66 which is suitably secured to base plate 46. Lever 63 engages arm 67 which is pivoted at 68 to support 69 which in turn is secured to the housing of motor 19 (Fig. 3). The end of arm 67 adjacent pivot 68 engages rotor spindle 47 to act as a brake thereon. A spring 70 is connected between arm 67 and upright 66 and rotates brake arm 67 about pivot 68 into braking engagement with spindle 47.

When coil 57 is energized plunger 59 is drawn to the left, as seen in Fig. 6, and, acting through resilient element 62, rotates lever 63 about pivot 64 in a clockwise direction to rotate arm 67 about pivot 68 to release the braking action upon spindle 47. Motor 19 is then free to drive through its gear train to rotate table 10. When one or the other of switches 15 or 16 are opened by the action of blocks 14 coil 57 is deenergized and spring 70 rotates arm 67 about pivot 68 into braking engagement with spindle 47 immediately terminating rotation of motor 19 and table 10.

The mechanical braking mechanism described above in considering Figs. 3 and 6 may be supplanted when motor 19 is a shaded pole induction motor by electrical braking. The circuit of Fig. 7 supplies a circuit for motor 19 including a source of low voltage direct current for braking motor 19. In this circuit switches 15 and 16 are again actuated by blocks 14 as described above and electrical current is alternately transmitted through these switches by any suitable timed alternator 71. Alternating current is supplied by suitable sources 20 and 21 which are connected through wires 22 and 29 with the primary windings of a suitable transformer 28. Secondary windings 30 of transformer 28 are connected by wire 31 through alternator 71 and wires 37 and 38 to switches 15 and 16. The other side of secondary winding 30 is connected by wire 33 to coil 34 of solenoid 35. The other side of coil 34 is connected by wire 36 to switch 16 and by wire 39 to switch 15. Switches 15 and 16 are normally closed and when alternator 71 engages either of its fixed contacts transformer 28, energized from sources 20 and 21, energizes solenoid 35. When solenoid 35 is energized solenoid actuated switches 72 and 73 close connections through lower contacts 74 and 75 respectively and motor 19 is supplied with alternating current from sources 20 and 21. When either switch 15 or 16 is broken by the action of blocks 14 solenoid 35 is deenergized and switches 72 and 73 make electrical engagement with upper contacts 76 and 77 respectively. Alternating electric current from sources 20 and 21 is then supplied to any suitable rectifier circuit generally indicated at 78 and a lower voltage direct current from rectifier circuit 78 is supplied through wires 79 and 80 respectively through upper contacts 76 and 77 respectively and through switches 72 and 73 respectively to motor 19 immediately terminating rotation thereof.

It is now apparent that the sample collector of the present invention is suitable for use with various sized sample

collecting containers **17**. Blocks **14** may be fixed to the underside of turntable **10** by any suitable adhesive or if turntable **10** is of magnetic material the blocks **14** may be magnets to adhere thereto. Thus block **14** may be readily positioned for any desired degree of rotation of table **10**.

In place of the clock timing device **13** or in place of the alternating timer **71** other suitable means may be employed, as required, to alternately close the parallel electrical circuits to the switches **15** and **16** to energize turntable **10**. If it is desired to control the rotation of turntable **10** by measurement of a predetermined volume of the samples in containers **17** a known volume sensing device or a drop counter or a liquid level sensing device could be substituted for the clock timing device **13** or the alternating timer **71**. If it is desired to initiate the rotation of turntable **10** in accordance with the temperature of a collected sample a thermocouple could be substituted for clock timer **13** or the alternating timer **71** to alternately close the parallel circuits **37** and **38**. It will thus be seen that the sample collector of the present invention is very flexible and easily adapted for use in almost every situation where samples are to be taken.

It should now be apparent to those skilled in the art that the novel sample collectors of the present invention in every way satisfy the several objects set out above. In particular it is seen that the sample collector of the present invention provides a novel device for automatically collecting samples at any desired time interval or in response to any desired condition of the sample and further that the samples collected may be taken in containers of various sizes as desired.

Changes in or modifications of the above described illustrative embodiment of this invention may now be suggested to those skilled in the art without departing from the present inventive concept. Reference should therefore be had to the appended claims to determine the scope of this invention.

What is claimed is:

1. In an automatic sample collector, a turntable, electric motor means for rotating said table, means for normally braking said motor, circuit means for said electric

means, a solenoid actuated switch in said circuit means, two parallel circuits supplying energy to said solenoid, means for alternately closing said parallel circuits responsive to a predetermined condition, means carried by said turntable for alternately breaking said parallel circuits at predetermined intervals to deenergize said solenoid means and break said circuit means, and means energized when said circuit means is closed for releasing said braking means.

2. A sample collector as described in claim 1 in which said means for alternately closing said parallel circuits includes a clock timer having adjustable contacts about its face alternately connected to one of said parallel circuits and having a driven contact successively engaging said adjustable contact connected to said parallel circuits.

3. A sample collector as described in claim 1 in which said means for alternately breaking said parallel circuits includes switch means in each of said parallel circuits and adjustable means driven by said turntable for opening said switch means.

4. A sample collector as described in claim 1 in which said means for normally braking said motor includes a brake element resiliently urged into contact with said motor and solenoid means for withdrawing said brake element connected across said circuit means.

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