

Oct. 20, 1964

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3,153,345

SAMPLE COLLECTOR

Filed June 21, 1961

2 Sheets-Sheet 1

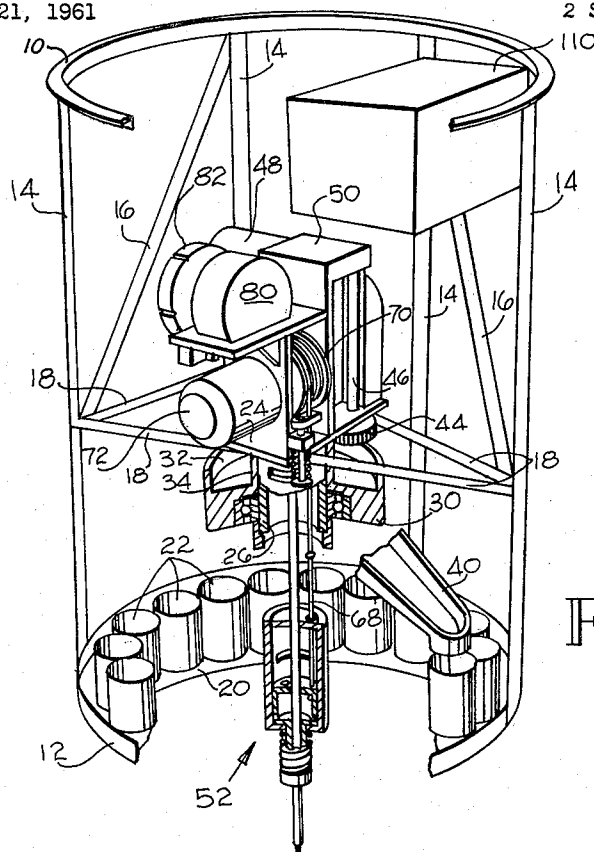


Fig 1

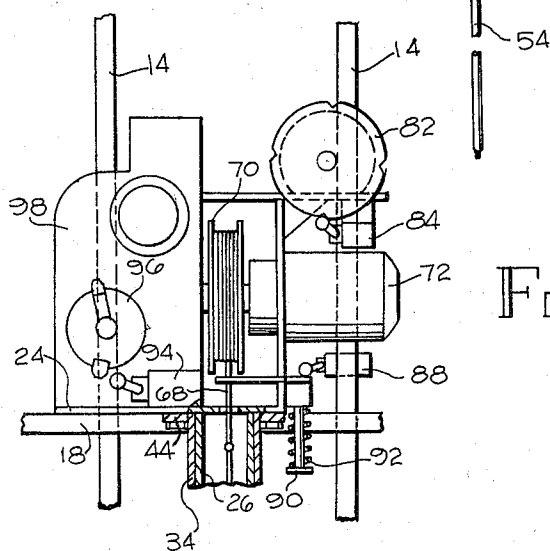


Fig 2

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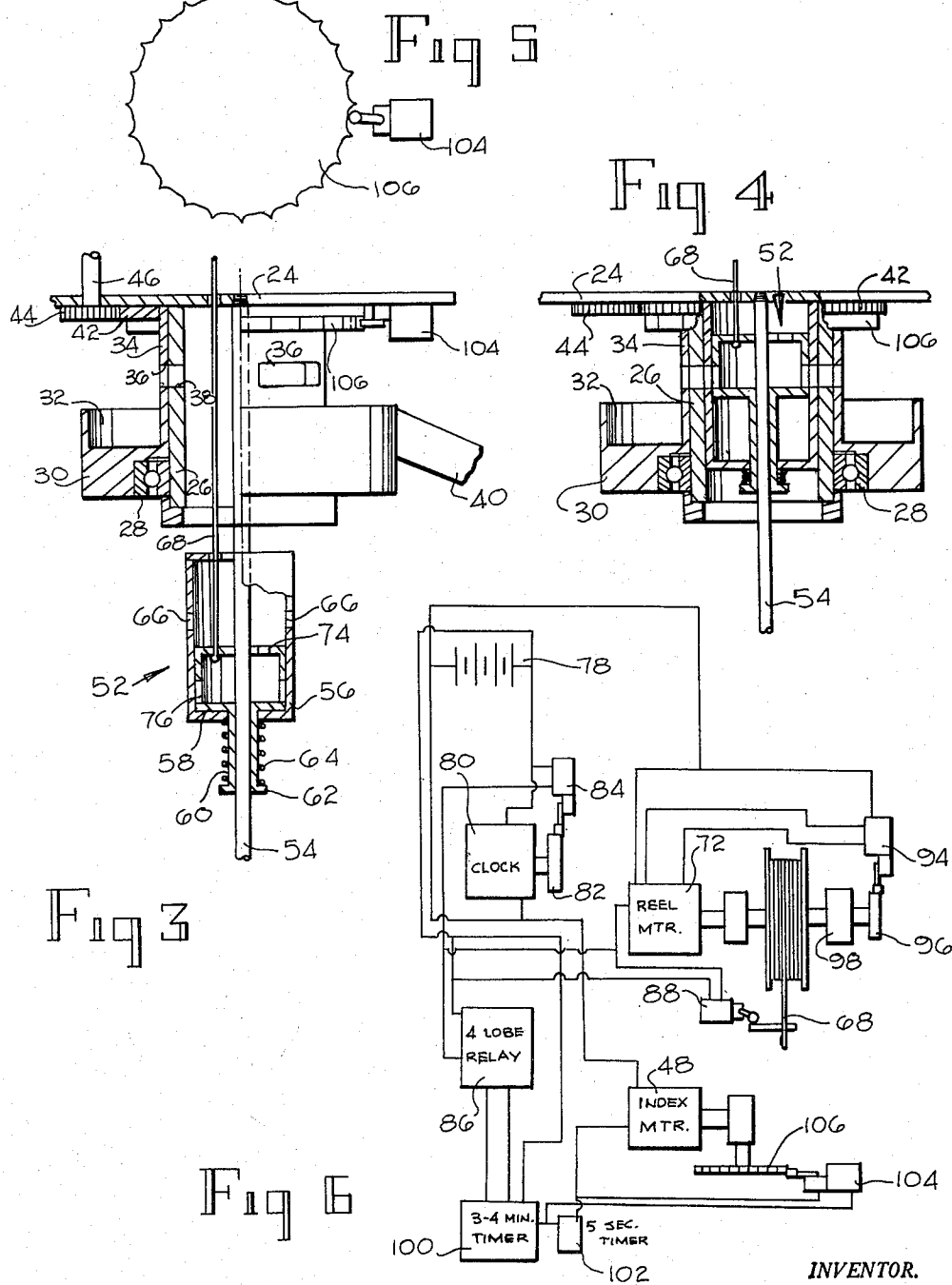
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SAMPLE COLLECTOR

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Filed June 21, 1961, Ser. No. 125,331

4 Claims. (Cl. 73-423)

This invention relates to a device for collecting samples of a liquid medium at regular intervals and has particular reference to a system for obtaining specimens of sewage flow.

In activities where a liquid or granulated solid is continually processed, it is often desirable to collect and store samples of the processed material for subsequent analysis. For example, in sewage treatment plants or in sewage systems which are susceptible to the occurrence of undesirable conditions, it may be valuable to obtain samples of the effluent at regular intervals for prolonged periods of time. If manually conducted, these sample collecting operations would require the almost full-time attention of an operator. It is therefore desirable to provide a mechanism which will automatically collect samples at regular intervals and store these for later analysis.

In order to assure the procurement of an average sample rather than a sample of some transient flow condition, the present invention contemplates a device having a plurality of sample holders which are sequentially filled with a series of specimens taken over short intervals. In this manner, each sample bottle contains an average specimen of flow taken over a short period of time. The sampling unit is powered under the direction of a control system which determines the time interval between samples, the number of samples which flow into a specimen bottle, and similar variables. This control system is of such construction as to be highly reliable in operation and easily adjustable to achieve another set of sampling times.

A preferred embodiment of the present invention, which will subsequently be described in detail, is specifically intended to obtain samples of flow through a sewer. The unit is designed to operate without attendance for 24 hours and to fill one specimen bottle during each hour. Each specimen bottle is filled with four samples taken at regular intervals over the hour. The mechanism broadly comprises a circular bottle rack which is indexed once an hour to bring another bottle under a sampling spout. On each quarter hour, a timer starts a cycle which lowers a sample bottle to the bottom of the sewer, raises the sample bottle and then empties its contents into the specimen bottle being serviced through the spout. After four such sampling operations have occurred, the bottle container is indexed to bring the next bottle into position.

It is a primary object of the present invention to provide such a sampler which is simple in construction so as to be low in cost and reliable in operation.

Another object is to provide a sampler which is flexible in operation so it may be used in many industrial operations.

Other objects, advantages, and applications of the present invention will be made apparent by the following detailed description of a preferred embodiment of the invention. The description makes reference to the accompanying drawings in which:

FIGURE 1 is a perspective view, partially broken away, of a preferred embodiment of the sewage sampler;

FIGURE 2 is a view of the operating mechanism of the sampler taken from the rear of the view of FIGURE 1;

FIGURE 3 is a detailed view of a portion of the sam-

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ple obtaining mechanism in a position wherein the sample bottle is being lowered;

FIGURE 4 is a view of the same mechanism as FIGURE 3 in a position wherein the sample bottle is being emptied;

FIGURE 5 is a top view of a cam associated with the bottle-changing mechanism; and

FIGURE 6 is a schematic view of the control circuitry of the device.

The preferred embodiment of the sampler is supported on a frame built between an upper circular angle-iron member 10 and a lower circular angle-iron member 12. A plurality of straight angle-iron members 14 are disposed in a vertical plane and have their two ends welded to the circular members 10 and 12. Angular struts 16 extend between members 14 to brace the unit. Three horizontal members 18 form a triangular framework within the angular members 14 and act to support the operating mechanism of the sampler.

The lower circular member 12 supports an inwardly extending horizontal shelf 20 which retains the sample or specimen bottles 22. The preferred embodiment of the invention is adapted to retain approximately 24 of these specimen bottles which are arranged in a circle about the shelf 20. The bottles 22 may be of any convenient configuration.

The angle-irons 18 support a plate 24 which forms the base of the operating mechanism of the sampler. An open cylindrical member 26 is supported from the lower side of the plate 24. At its lower outer edge, the cylinder 26 retains a ball bearing 28 which in turn rotatably supports a cylindrical drain shelf 30. The shelf 30 contains a trough 32, and a collar 34 which fits over the cylinder 26.

A series of vertical drain slots 36 in the collar 34 are in alignment with a set of similar slots 38 which are formed in the cylinder 26. A drain spout 40 passes through the wall of the trough 32 and is fixed to the shelf 30. The lower end of the spout 40 is in line with the mouths of the specimen bottles 22. The arrangement is such that when liquid passes through the drain spouts 36 and 38 and runs into the trough 32, it is carried out of the spout 40 and into the specimen bottle 22 disposed below the extreme end of the spout.

The upper end of the collar 34 carries an annular gear 42, which is driven by a pinion 44. The pinion 44 is attached to a shaft 46 which passes through the plate 24. The upper end of the shaft 46 is powered by an electric motor 48 operating through a right-angle drive 50.

The rotation of the shaft of the motor 48 is transmitted through the right-angle drive 50 and the shaft 46 to rotate the pinion gear 44. This causes the spout support 30 to rotate on the bearing 28 about the cylindrical member 26 and causes the spout 40 to be moved from one of the sample containers 22 to the next. The manner of controlling the rotation of the motor 48 to cause the spout to index just one container will be subsequently described.

The sample collector, generally indicated at 52, is capable of vertical movement along a rod 54 which depends from the lower side of the plate 24 so as to extend down the center of the cylindrical member 26. The rod 54 may be formed of a plurality of sections so as to be of sufficient length to reach the bottom of the collection point. Sample collector 52 includes a generally closed cylindrical member 56 which has central holes in its upper and lower ends which pass the rod 54. A cylindrical cup 58 fits within the member 56 and has a neck 60 which extends downwardly through the lower hole in the member 56 and embraces rod 54.

The neck 60 has a flange 62 on its lower end which acts to retain a spring 64 that is wound about the neck and has its upper end in contact with the lower edge of the cylinder 56. Thus the spring 64 acts to maintain the cup 58 in the lower end of the cylinder 56.

The cylinder 56 has a series of side vents 66 disposed midway about its perimeter at a point above the maximum extension of the cup 58 when it is in its lowered position as illustrated in FIGURE 3.

The sample collector 52 is lowered and lifted along the rod 54 by a cable 68 which passes through a hole in the top of the cylinder 56 and has its lower end attached to the top of the cup 58. The cable 68 is wound about a drum 70 which is driven by an electric motor 72. The motor rotates the drum in such a manner as to extend the cable 68 and sample collector 52 is lowered along the rod 54 until it reaches the sampling point. At this point the control mechanism de-energizes the motor 72 in a manner which will be subsequently described. The fluid to be sampled then passes into the collector 52 through the holes 66 and then into the cup 58 through a hole 74 in the top of the cup. The cup has a series of holes 76 along the lower edge of its sides but these holes are blocked by the wall of the cylinder 56 when the cup is in a lowered position.

After reaching the bottom the control reverses the electric motor 72 and raises the sample collector 52. When the top edge of the cylinder 56 comes in contact with the bottom of the plate 24 the cylinder 58 stops its vertical movements but the cup 58 continues to rise until the holes 76 in its outer wall are in alignment with the holes 66 in the cylinder 56 at which point the control halts the motor. This condition is illustrated in FIGURE 4. The sample contained in the cup 58 then passes through the holes 76 and 66 and runs into the trough 32, from which it passes out the spout 40 into the sample bottles 22 which are positioned beneath the spout.

Control System

The control for this device is illustrated schematically in FIGURE 6. It is powered by a store battery 78 which, in the preferred embodiment is of the 12 volt variety, and is centrally timed by electric clock 80. The clock 80 has its output shaft driven so as to make one revolution per hour. It drives a cam 82 which has four equally spaced indentations about its perimeter. The presence of these indentations is sensed by a limit switch 84. Each time one of the indentations of the cam 82 passes the contact arm of the limit switch 84 an electric pulse is sent to a 4 lobe timing relay 86 which acts as a counter to provide an output signal after 4 output pulses are received. The limit switch 84 also provides power to the reel motor 72 as long as its arm is in the indentations about the perimeter of the cam 82. This starts the reel motor rotating in such way as to lower the cable 68. Another, normally closed limit switch 88 senses the presence of the sample collector 52 in its position at the top of the rod 54 by means of a stop plate 90 which is spring loaded into a position wherein its top is out of contact with the arm of the limit switch 88. However, when the sample collector 52 is in its top position the arm 90 is raised against the bias of the spring 92 to open the normally closed limit switch 88.

The limit switch 88 closes the circuit to the reel motor 72 while the sample collector 52 is removed from the top position on the rod. Thus the reel motor is started by the limit switch 84 but the limit switch 88 takes over the function of maintaining power to the motor 72 while the sample collector 52 completes its cycle. A third limit switch 94 acts to reverse the power to the reel motor 72 when the sample collector 52 reaches its sampling position. The limit switch 94 is actuated by a cam 96 that is driven by the reel motor 72 through a speed reducer 98.

When the cam 82 has come through a full revolution so as to provide 4 pulses to the relay 86 a pulse is pro-

vided to an electric timer 100 which closes its output by approximately 3 to 4 minutes. The timer 100 provides power to the index motor 48 which rotates the spout 40. The electric path of the index motor is completed by either a 5 second timer 102 or an open limit switch 104 which is connected in parallel. The limit switch 104 senses a 24 lobe cam 106 which is supported directly below the annular gear that drives the drain shelf 30. The cam opens the limit switch 104 whenever one of the sample bottles 22 is positioned directly below the spout 40.

When the timer 100 first closes, one of the bottles 22 is in position under the spout 40 so that the limit switch 104 is opened. Power is therefore passed through the reel motor and through the 5 second timer 102. By then 5 seconds have elapsed and the index motor 48 has rotated the cam 106 sufficiently to close the limit switch 104 which remains closed until the next bottle is in position under the spout 40. In this manner the bottles 22 will advance once each hour.

The batteries and part of the electrical control system are housed in a panel 110 which is supported on the framework 14.

Having thus described my invention I claim:

1. A sample collecting device, comprising: a plurality of sample receiving receptacles; a sample dispensing device; means for sequentially bringing said receptacles to filling position with respect to said sample dispensing device; a sample pickup device operative for reciprocating vertical movement and having means for receiving a sample in which it is immersed at the lower end of its movement and for releasing said sample to said dispensing device at the upper end of its movement; and a control system operative to lower and raise said sample receiving device at regular intervals and to index said specimen bottles with respect to said sample dispensing device after a particular number of reciprocations of said sample pickup device, including a timer operative to emit electrical pulses at regular intervals, a counter operative to receive said pulses and to emit a pulse after a plurality of said timer pulses have been received, means responsive to said timer pulses for raising and lowering said sample receiving device, and means responsive to said counter pulses for indexing said specimen bottles.

2. A device for obtaining and storing samples of a flowing fluid, comprising: a central vertical rod having its lower end disposed in the flowing fluid; a sample pickup device operative for movement along said rod; a winch having its cable attached to said sample pickup device; means for periodically rotating the winch so as to lower said sample pickup device to lower end of said rod and then raise said sample pickup device; means for filling said sample pickup device at the lower end of its travel and for dispensing said sample at the upper end of its travel; a trough operative to receive a sample from said pickup device at the upper end of its travel; a spout extending from said trough: means for rotating said trough and spout about its central axis; a plurality of sample specimen bottles arranged to receive specimens passed through said spout; means for rotating said trough and spout about its axis so as to bring said spout into operating position with various of said specimen bottles; and a control system including a timer adapted to emit pulses at regular intervals, means for energizing said winch in a first direction upon reception of a pulse from said timing device, means for reversing the rotation of the winch upon the pickup device reaching the lower end of its travel, means for halting the operation of said winch upon the pickup device returning to the upper end of its travel, a counter operative to receive said timer pulses and to emit a pulse after the reception of said timer pulses, and means responsive to said timer pulses for causing said trough and spout to rotate with respect to said specimen bottles.

3. A device for obtaining and storing samples of flowing fluid comprising: a central vertical rod having its lower

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end disposed in the flowing fluid; a sample pickup device operative for movement along said rod, said pickup device comprising an inner and an outer compartment disposed coaxially about said rod, the inner compartment being reciprocable with respect to the outer compartment in a vertical direction, spring means normally biasing the inner compartment to its lower position with respect to the outer compartment, and means for dispensing the contents of the inner compartment when it is in its higher position with respect to the outer compartment; a winch having its cable attached to the inner compartments so as to lower the sample pickup device when it extends its cable and to raise the sample pickup device when it retracts its cable; and stop means associated with the retracted position of the cable operative to engage the outer compartment so as to cause the cable to raise the inner compartment to its higher position with respect to the

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outer compartment and thereby dispense fluid contained in the inner compartment.

4. The structure of claim 3 wherein a plurality of specimen receptacles are arranged so as to be indexed relative to the sample pickup device and a control system is provided for indexing the specimen receptacles after a particular plural number of extensions of the winch cable.

References Cited in the file of this patent

UNITED STATES PATENTS

1,101,568	Roberts	June 30, 1914
1,494,631	Roberts	May 20, 1924

FOREIGN PATENTS

123,173	Great Britain	Feb. 18, 1919
1,030,043	France	Mar. 11, 1953