May 30, 1950 C. W. COX 2,509,264

SAMPLING DEVICE

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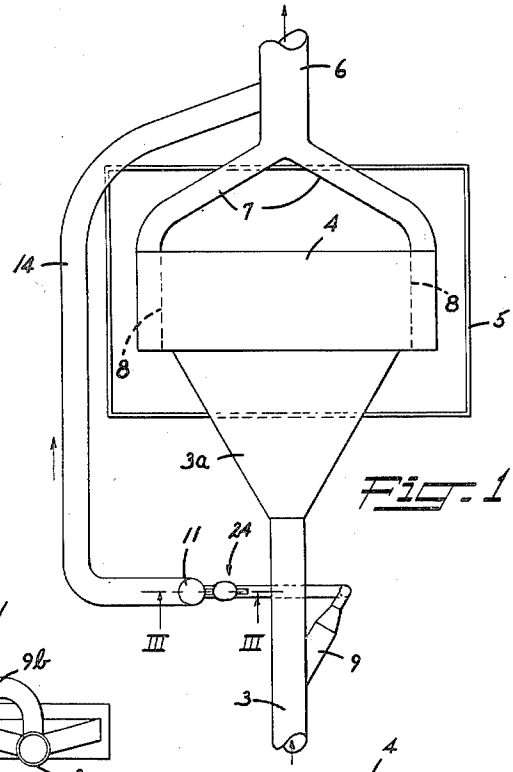


Fig. 1

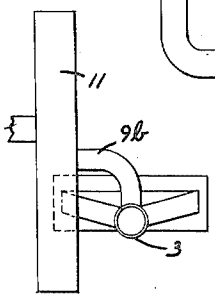


Fig. 5

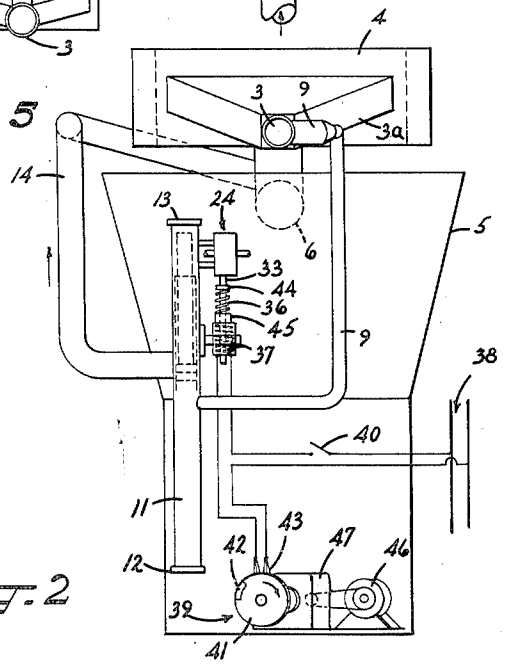


Fig. 2

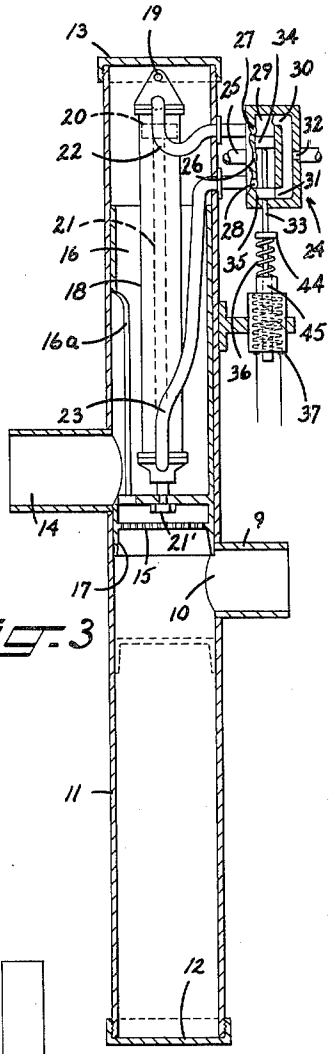


Fig. 3

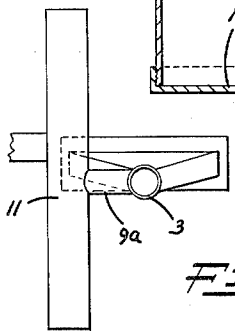


Fig. 4

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SAMPLING DEVICE

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4 Claims. (Cl. 73—422)

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This invention relates to sampling devices and is particularly concerned with a device adapted to take samples of a fluid medium, such as of vapor or gas, or of suspended materials within a gasous or vaporous fluid medium. Such suspended materials may be dust particles, pigments, fibers, grains, sand, gravel, and other particulate materials, such as wood flour, sawdust or other fillers used in the plastic industries. Thus, the sampling device is applicable to numerous industries including textile industry for sampling fibers, the food industry for sampling cereal grains, the plastics industries for sampling fillers, and what not.

It is a particular object of the invention to provide an apparatus for taking samples automatically at definite intervals so as to provide representative selections of the material. A further object of the invention is to provide a sampling device which is capable of withdrawing automatically or withdrawing at intervals representative samples from a flowing stream of the fluid or fluid suspension. Other objects and advantages of the invention will be apparent from the drawing and the description thereof hereinafter.

In the drawing, illustrative of the invention—

Figure 1 is a plan view, in somewhat diagrammatic form showing one embodiment of the appilcation as applied to the sampling of a fiber suspension,

Figure 2 is an elevation of the embodiment of Figure 1,

Figure 3 is an enlarged sectional view, on line III—III of Figure 1, of the sampling device itself,

Figure 4 is a diagrammatic view in elevation of a modified arrangement, and

Figure 5 is a diagrammatic view in elevation of a second modified arrangement.

Figures 1 to 3 show the sampling device installed upon a fiber-conveying system such as is used in the textile industry for taking fibers from a dryer and delivering them to a packaging system, such as a baling press. Such fibers may be natural or artificial, such as cotton, wool, silk, rayon, nylon, saran, etc. In the installation shown, the fibers proceed through the discharge duct 3 coming from the dryer or other source of fiber to a rotary condenser 4 from which the fibers are discharged downwardly into the hopper 5 of a baling press or other receiving system. The duct 3 may flare out as at 3a as it approaches the condenser 4. To effect deposition of the fibers upon the condenser, suction is applied to a duct 6 which communicates by means of ducts

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7 with the end chambers 8 of a conventional rotary condenser. In such a condenser, the suction in the end chambers exerts its influence upon the interior of the perforated drum of the condenser along the portion of its periphery upon which the fiber-conveying stream first makes contact. Suitable radial partitions within the perforated drum and fixed diaphragms at the ends of the drum are provided upon conventional condensers for this purpose and will not be described.

In order to take a representative sample from the fiber suspension as it proceeds to the condenser, a branch duct 9 is connected with duct 3 and preferably extends away from duct 3 in the direction of flow of the fibers therethrough, such direction being at an angle as shown. The duct 9 opens at 10 into the cylindrical housing 11 of the sampling device. The sampling device is preferably disposed in a vertical disposition though it may be inclined thereto if desired and the opening 10 is generally spaced a substantial distance from the bottom of the cylinder 11. The lower end of the cylinder 11 is closed by a readily removable cap 12 and the upper end is similarly provided with a cap 13. A duct 14 is connected to the suction duct 6 and to the cylindrical housing 11 at a point between the connection 10 and the cap 13.

Within the housing 11 there is provided a plunger or piston 16 which has a tight sliding fit within the inside wall of the housing 11. The head or base of the piston is constituted of, or provided with an insert constituted of, a fluid-pervious separator, such as a screen or filter 15. The separator 15 is preferably spaced back of the outer edge of a tapering annular rim 17 projecting from the head and provided for the purpose of pushing downward any fibers that may be partway within the housing 11 and partway within duct 9 as the edge of rim 17 passes over the opening 10. The skirt of plunger 16 is provided with a slot 16a which registers with the opening of duct 14 into cylinder 11.

Means is provided for reciprocating the plunger 16 within the cylinder 11 and such means may advantageously take the form of the hydraulic or pneumatic cylinder 18 suspended by means of a cross pin or rod 19 at the upper end of the cylinder 11. A piston 20 within cylinder 18 is connected by a rod 21 with the head of the plunger such as by the nut 21'. Pipes 22 and 23 respectively are provided to introduce air, liquid or the like in the opposite ends of the cylinder 18 to reciprocate the piston 20 and the plunger 16 one

way or the other. The feed to the lines 22 and 23 is controlled by the valve 24. The source of air, liquid, or the like is connected by line 25 to the intermediate port 26 of the valve housing, whereas lines 22 and 23 are connected to the outer ports 27 and 28 respectively. The bore 29 with which the ports communicate also communicates at its ends with ports 30 and 31 which communicate with the discharge port 32. Within the bore 29 a spool valve rod 33 reciprocates and is provided with the enlarged portions 34 and 35 to control the flow of the hydraulic or pneumatic fluid. The valve rod 33 is normally urged upwardly by a spring 36 bearing against a collar 44 secured to the rod 33 and against a fixed abutment or bracket 45. The valve rod is moved downwardly by means of a solenoid 37 provided within the circuit to a source of power 38 and a controlling timer 39. A manually-controlled main switch 40 may be provided within the circuit and the timing device is provided with an insulating disc 41 having a conductive insert 42 which is of sufficient arcuate length to contact both of the brushes shown at 43 and to maintain the desired time of contact for sampling purposes. A motor 46 is provided to drive the timing disc 41 through a reduction box 47.

During operation of the device, the normal rest position of the plunger 16 within cylinder 11 is in the lower end of the cylinder (dotted line position of head 15 shown in Figure 3) where it blocks intercommunication between the duct 9 and the duct 14. When, however, the insert 42 of the timing device connects the brushes 43, the valve rod 33 is moved to its lower position (that shown in Figure 3) so that the air or other fluid is discharged from the upper end of cylinder 18 while it is introduced into the lower end of such cylinder. This causes reciprocation of the plunger 16 into the solid line position shown in Figure 3. This position is held until insert 42 passes beyond one of the brushes and interrupts the circuit to the solenoid 37, at which time the spring 36 causes reversal of the valve rod and descent of the plunger 16 to its resting position. During the ascent of plunger 16, the plunger gradually opens duct 9 so that the suction through duct 14 draws fibers into the cylinder 11 and sucks them against the lower side of the separator 15. This is continued during the descent of the plunger 16 until duct 9 is again closed, upon which event, the fibers fall from the separator to the bottom of the cylinder 11 or any equivalent receptacle attached thereto. The operator may take a sample from the chamber at any desired interval by removing the cap 12. He may do this between every reciprocation of the plunger 16, or he may take it at certain time intervals during which a number of individual samples are accumulated corresponding to the number of strokes of plunger 16 during this period. The size of the individual samples can be determined by the proper correlation of the size of ducts 9 and 14, the size of insert 42, and the speed of rotation of disc 41.

In the embodiment of Figures 1 to 3, the fluid suspension being sampled is conveyed downwardly through duct 9 to the cylinder chamber 11. This is satisfactory when dealing with simple vapors or gases or gaseous suspensions containing light particles, such as fibers or dusts. For some types of suspensions, where the particles are heavier and more inclined to settle out rapidly, it is preferred to have a more direct connection

between the conveying duct, such as duct 3, and the sampling device. In Figure 4, the sampling device is elevated to a higher position than in the embodiment of Figures 1 to 3 so that the conduit 9a branching off at an acute angle from duct 3, like duct 9 in Figure 1, is connected to the cylinder 11 of the sampling device at a very short distance from the duct 3 and the duct 9a provides a straight-line path from duct 3 to sampler housing 11. In Figure 5, a modification is shown in which the duct 9b goes upwardly from the duct 3 and over to the cylinder 11 which is disposed in somewhat higher relationship than shown in the other two embodiments.

The sampling device is extremely useful for the selection of representative samples of staple rayon fiber which can then be subjected to tests for moisture content, fiber length distribution, and carding qualities. When suspensions of other particulate materials are collected by the device, they may be subjected to the appropriate tests corresponding to the character of the material. Thus, the qualities of cereal grains may be tested in conventional fashion; the proportion of dust in an air stream of a conditioning unit may be measured, and its character may be analyzed. The uniformity and quality of pigments, fillers, or mixtures thereof may be readily measured with reliability by using this sampling apparatus.

It will be understood that changes and variations may be made without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. A device for sampling a fluid material comprising a chamber, a lateral inlet duct intermediate the ends of the chamber for admitting a fluid material to be sampled to the chamber, a conduit adapted to communicate with a source of suction and connected to the chamber at a position between the inlet and one end of the chamber, a plunger having a sliding fit in the chamber and having a fluid-pervious separator in its head, the plunger being reciprocable from a position blocking the inlet to a position out of the way of the inlet with the separator between the inlet and the suction conduit, means for reciprocating the plunger between said positions, and means for gaining access to the chamber for removing the sample collected therein.

2. A device in accordance with claim 1 in which the head of the plunger is provided with a tapered rim projecting from the separator in the head.

3. A device in accordance with claim 1 in which the reciprocating means comprises a cylinder in the end of the chamber near the suction conduit and a fluid-operated piston in the cylinder.

4. A device in accordance with claim 1 in which the chamber is cylindrical and the means for gaining access is a cap secured to the end thereof toward which the head of the plunger faces.

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