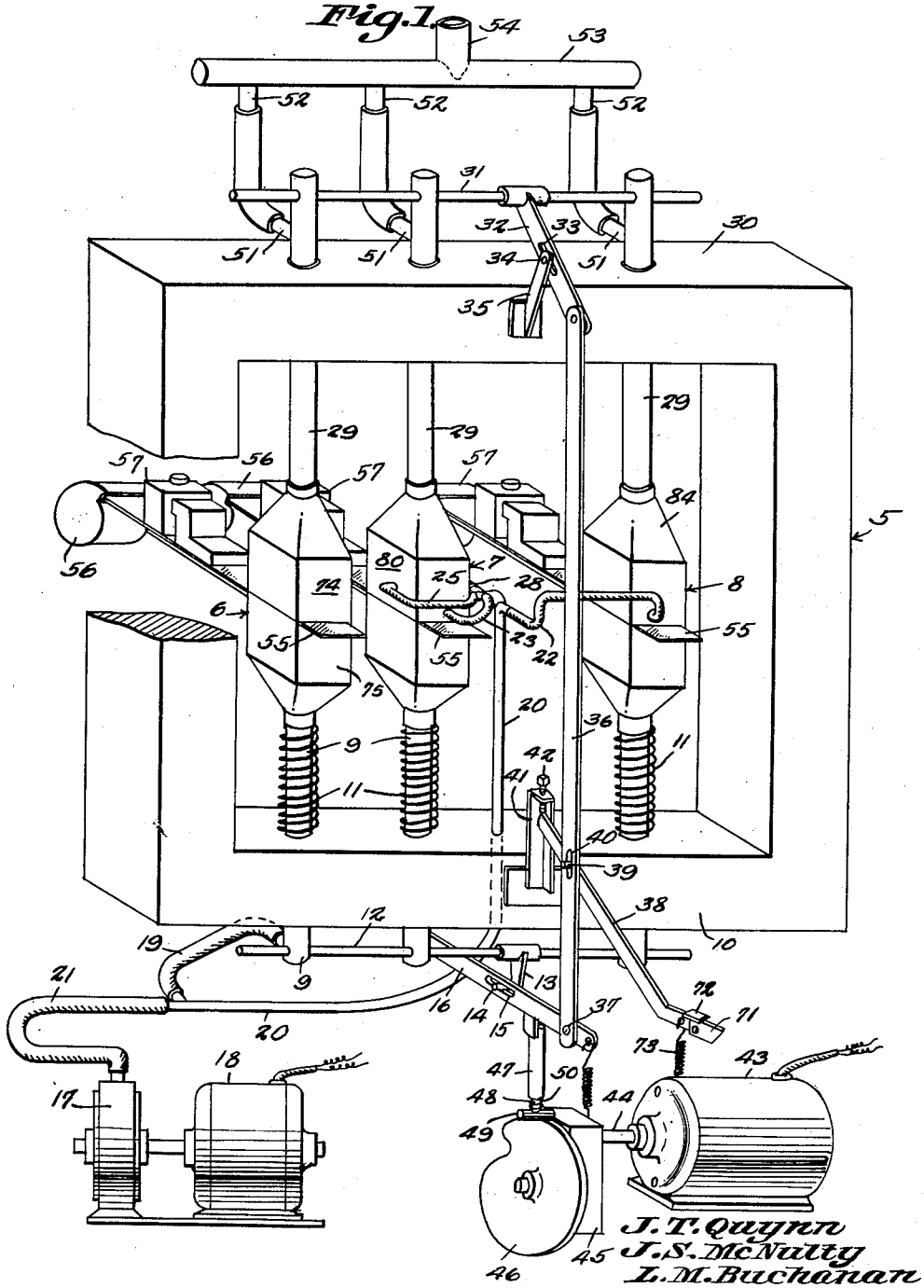
April 20, 1954 J. T. QUYNN ET AL 2,675,697

MULTIPLE CONTINUOUS AIR SAMPLER

Filed Nov. 24, 1950 3 Sheets-Sheet 1

Fig. 1.



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MULTIPLE CONTINUOUS AIR SAMPLER

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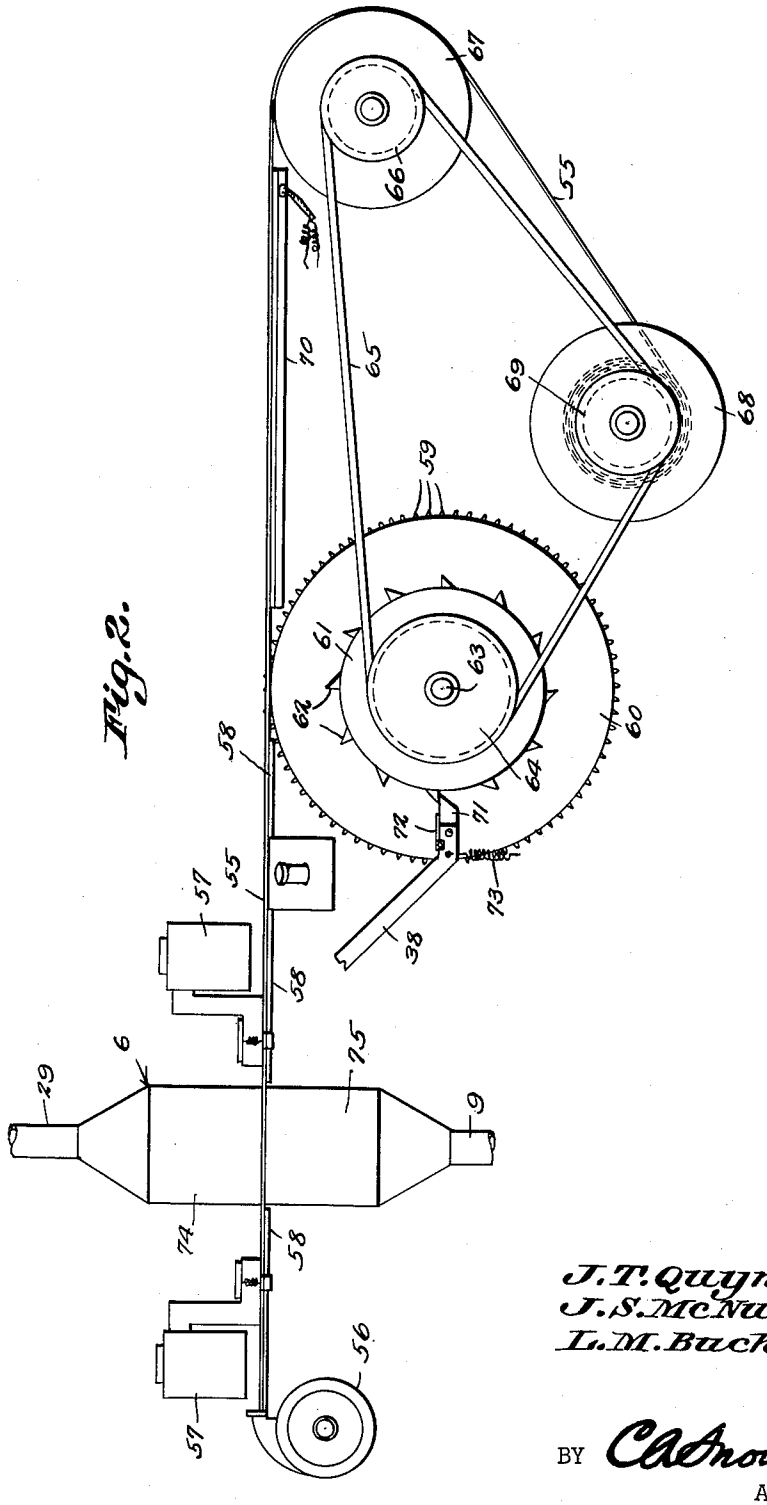

Fig. 2.

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MULTIPLE CONTINUOUS AIR SAMPLER

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Fig. 3.

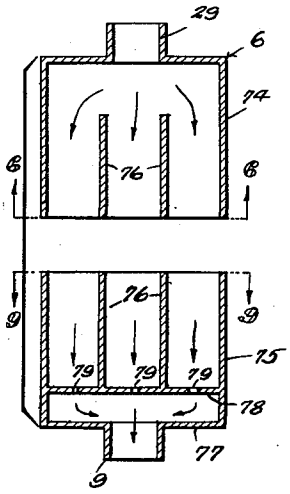


Fig. 4.

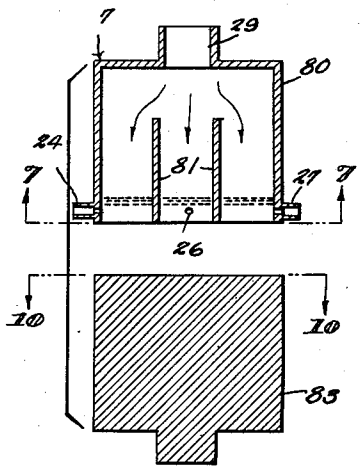


Fig. 5.

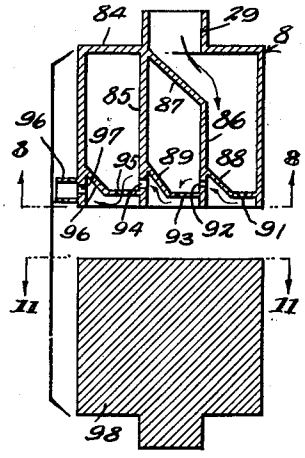


Fig. 6.

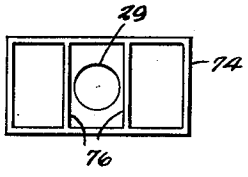


Fig. 7.

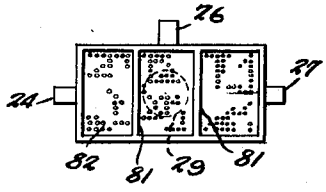


Fig. 8.

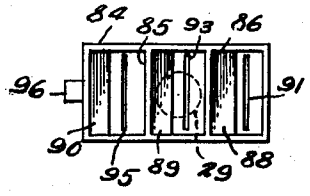


Fig. 9.

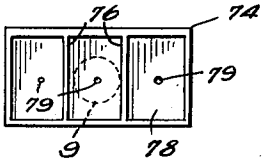


Fig. 10.

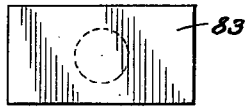
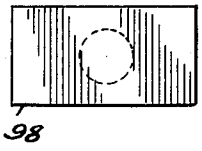


Fig. 11.



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2,675,697

UNITED STATES PATENT OFFICE

2,675,697

MULTIPLE CONTINUOUS AIR SAMPLER

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Application November 24, 1950, Serial No. 197,458

1 Claim. (Cl. 73—28)

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This invention relates to an apparatus designed for use in gathering data concerning various known types of air-borne particulates, the primary object of the invention being to provide a multiple portable apparatus of a flexible type by means of which quantitative as well as qualitative analyses may be made of the concentrates of various types of air-borne particulates over predetermined periods of time, indicating changes in concentrations during equal intervals within the sampling period.

Another object of the invention is to provide a device of this character which will collect specimens from which data may be compiled indicating the particle size, and distribution of the particulates that are air-borne and sampled at concurrent intervals with each sample measuring concentrations.

Another object of the invention is to provide an apparatus for obtaining specimens of the air of room areas to determine air-borne particulates by causing the air to be directed onto a moving web, particulates in the air being deposited on the web for further examination.

A still further object of the invention is to provide an apparatus wherein the webs on which the deposits are made, will be fed through the various sampling heads, intermittently, so that the webs may be stopped and subjected to the air for a period of time to insure the proper quantity of particulates being deposited for a successful examination.

With the foregoing and other objects in view which will appear as the description proceeds, the invention consists of certain novel details of construction and combinations of parts hereinafter more fully described and pointed out in the claim, it being understood that changes may be made in the construction and arrangement of parts without departing from the spirit of the invention as claimed.

Referring to the drawings,

Figure 1 is a perspective view illustrating an apparatus constructed in accordance with the invention.

Fig. 2 is a fragmental side elevational view of the apparatus.

Fig. 3 is a vertical sectional view through one form of vacuum head.

Fig. 4 is a sectional view through a modified form of vacuum head.

Fig. 5 is a vertical sectional view through a further modified form of vacuum head.

Fig. 6 is a view taken on line 6—6 of Fig. 3.

Fig. 7 is a view taken on line 7—7 of Fig. 4.

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Fig. 8 is a view taken on line 8—8 of Fig. 5.

Fig. 9 is a view taken on line 9—9 of Fig. 3.

Fig. 10 is a view taken on line 10—10 of Fig. 4.

Fig. 11 is a view taken on line 11—11 of Fig. 5.

Referring to the drawings in detail, the apparatus embodies a frame indicated generally by the reference character 5, which frame supports the vacuum heads 6, 7 and 8, each of which embodies lower and upper sections, the lower sections being secured at the upper ends of the vacuum pipes 9 that are disposed in openings in the lower bar 10 of the frame 5.

Coiled springs 11 surround the vacuum pipes 9 and rest on the upper surface of the lower bar 10, normally urging the lower sections of the vacuum heads towards the upper sections thereof.

These vacuum pipes 9 are connected with the supporting rod 12 to which the arm 13 is connected, the arm 13 having a right angled end 14 moving in the elongated opening 15 of the lever 16, whereby vertical movement of the lever 16 will tend to rotate the supporting rod 12 and cause the supporting rod 12 to move downwardly against the action of the springs 11, the springs 11 acting to return the pipes and sections of the vacuum heads supported thereon, to their normal positions with each movement of said rod.

The reference character 17 indicates the vacuum pump which is driven by the electric motor 18, the vacuum pump 17 being in communication with the pipe 9, through the hose 19, pipe 20 and hose 21.

As shown by Fig. 1 of the drawings, the pipe 21 extends upwardly through an opening in the lower bar 10 of the frame, and terminates at a point adjacent to the upper sections of the vacuum heads 7 and 8. The reference character 22 indicates a flexible hose which extends from the pipe 20 to the upper section of the vacuum head 8, communicating with the upper section, at one side of the vacuum head, as shown by the drawings.

The flexible pipe or hose 23 also connects with the pipe 20, and extends to the upper section of the vacuum head 7, connecting with the upper section of the vacuum head 7 through the opening 24. The hose 25 connects with the pipe 20 and is in communication with the upper section of the vacuum head 7, through the extension 26 at one side thereof.

An extension 27 connects with the hose 28 that also connects with the pipe 20.

Connected with the upper sections of the vacuum heads 6, 7 and 8, are pipes 29 that extend through openings in the upper bar 30 of

the frame 5. These pipes are connected by the horizontal rod 31 to which the arm 32 is connected to rotate thereon, the arm 32 having an elongated opening 33 in which the pin 34 from the bracket 35 extends. One end of the arm 32 is pivotally connected with the operating bar 36 that extends downwardly and has pivotal connection with the lever 16, at 37. The operating bar is moved vertically by the bar 38 which is provided with a laterally extended pin 39 that moves through the vertically elongated opening 40 formed in the operating bar 36. One end of the bar 38 moves in the stationary guide 41 and engages the adjusting screw 42 that moves through a threaded opening in the upper end of the stationary guide, regulating the stroke of the bar 38 thereby regulating the stroke of the operating bar 36. The electric motor 43 has its shaft 44 extended into the reduction gear box 45, the gearing of the gear box operating the cam 46, the construction of the cam 46 being such that the cam 46 rotates slowly.

Extending downwardly from the lever 16, and secured thereto, is the cylinder 47 in which the rod 48 operates, the rod 48 having the transversely disposed end piece 49 that rests on the edge of the cam. The rod 48 is normally forced towards the cam 46, by means of the coiled spring 50 which surrounds the rod and has its ends bearing against the end piece 49 and lower end of the cylinder 47. Thus it will be seen that with each rotation of the cam 46, the outer end of the lever 16 will be reciprocated or swung vertically to operate the operating bar 36.

An extension pipe 51 forms a part of each pipe 29, and connects with the extensions 52 that extend from the pipe 53 of the sampling air intake manifold 54 which communicates with the atmosphere to draw the atmosphere into the vacuum heads. The reference character 55 indicates films or webs which are constructed of any desirable material, such as filtering cloth or plastic material depending on the tests to be made.

These webs or film strips are rolled in the cartridges 56 and move under the tanks 57 that contain film or web treating material designed to maintain the specimens in condition for test.

The films or webs move through the guides 58 maintaining the films or webs in their proper positions for feeding through the apparatus.

The webs or films are provided with lines of perforations at their edges, in which the teeth 59 are formed on the periphery of the driving drum 60, the driving drum 60 having the hub 61 on which the ratchet teeth 62 are formed. Mounted on the shaft 63 which supports the drum 60, is the pulley 64 over which the belt 65 operates, which belt also operates over the pulley 66 of the guide drum 67 mounted at one end of the machine and over which the web or film 55 is guided, to the spool 68 which is also provided with the pulley 69 over which the belt 65 operates, to wind the film on the spool. Located directly under the stretch of web or film, between the driving drum 60 and guide drum 67, is the electric heater 70 which is designed to maintain the web or film at the desired temperature to preserve the bacteria or germs so that an accurate test may be had.

Pawl 71 is mounted on one end of the arm 38 and is held against the stop 72, by means of the coiled spring 73, and pawl 71 engaging the ratchet teeth 62 as the driving drum 60 rotates, thereby moving the outer end of the bar 38 downwardly to cause the upper sections of the vacuum or sampling heads 6, 7 and 8, to move downwardly into engagement with the webs moving thereunder. It will of course be understood that the cam 46 will be timed in such a way that the lower movable sections of the vacuum or sampling heads 6, 7 and 8, will be moved upwardly towards the upper sections of the vacuum or sampling heads to positions as shown by Fig. 1 of the drawings, whereby the sections of the sampling or vacuum heads will be moved against the web or films moving therethrough.

In Sheet 3 of the drawings, are illustrated the various forms of vacuum or sampling heads, and as shown by Fig. 3 of the drawings, the upper and lower sections 74 and 75 respectively, are provided with spaced partitions 76 arranged in parallel spaced relation with respect to each other, the partitions of the sections adapted to align when the sections of the vacuum or sampling heads are brought together against opposite sides of a web or film. The partitions 76 in the lower sections 75, are separated from the bottom 77, by the horizontal partition 78, which horizontal partition is provided with openings 79, so that air drawn into the vacuum or sampling head 6 by the vacuum pump 17, may be drawn directly through the vacuum or sampling head leaving deposits for test on the web or film operating through the vacuum head. In the form of the vacuum or sampling head as shown by Fig. 4 of the drawings, it will be seen that the upper section 80 of the head is provided with parallel spaced partitions 81 with a horizontal perforated bottom 82 arranged therein. Instead of a hollow lower section as in the structure shown by Fig. 3, the lower section of the sampling head is formed to provide an anvil 83. This type of head is used when an impervious or plastic film is used against which the air impinges, the air-borne particulates impinging on the film which is held solidly by the anvil 83, with the result that the air-borne particulates will adhere to the film.

The suction of air through the vacuum or sampling head created by the vacuum pump 17 is through the pipes 26 and 27, which connect with the pipe 20, through hose 23, 25 and 28. The construction of the vacuum or sampling head 8 is somewhat different from the previously described vacuum or sampling heads, and as shown, the upper section of this sampling head, indicated by the reference character 84 is provided with vertical partitions 85 and 86, the partition 86 having an upwardly inclined end portion 87 which connects with the upper end of the partition 85 cutting off passage of air entering the upper section, into the compartments formed by the partitions 85 and 86, at the upper ends of the compartments.

Bottom members 88, 89 and 90 are provided in the upper section and provide spaces between the lower end of the upper section and compartments formed by these bottom members. The bottom member 88 is formed with a discharge opening 91 so that air passes downwardly through said opening into the space below the bottom member 88. An opening 92 establishes communication between the space below the bottom member 88, and space above the bottom member 89, so that air-borne particulates of a particular size will be confined to the space under the bottom member 88, while the finer particulates will pass into the space above the bottom member 89 and be drawn from this space, through the opening 93 formed in the bottom member 89. A sub-

stantially large opening 94 provides communication between the space below the bottom member 89 and the space above the bottom member 90 so that the suction of air-borne particulates which have not been deposited in the spaces below the bottom members 88 and 89, will be carried into the space above the bottom member 90, from where they will pass into the space below the bottom member 90, through the opening 95, the suction of air continuing through the hose 22 which is fitted over the extension 96 that surrounds the discharge opening 97. The lower section of the vacuum or sampling head 8 is also in the form of an anvil indicated at 98, and provides a support for the web or film passing thereover, the air-borne particulates being forced against the film or web adhering thereto, to be carried from the head and wound on a spool for test.

It will of course be understood that there will be provided a guide drum 67 and spool 68 for each web or film passing through the apparatus, and the number of these webs and vacuum or sampling heads may be varied without departing from the spirit of the invention.

In operation, the apparatus is positioned in a room, or in a location from which a specimen of the air is to be obtained for the purpose of gathering data concerning all manner and types of air-borne particulates.

The motors of the apparatus are started, and the vacuum pump 17 causes a suction through the vacuum or sample heads. The webs or films are moved through the space between upper and lower sections of the vacuum heads, and the air is drawn through the vacuum heads depositing the air-borne particulates on the webs, which are wound onto the spools 68.

It will of course be understood that the webs or films are moved through the heads 6, 7 and 8, with a step by step movement, so that the films remain stationary for a predetermined period, or a length of time sufficient to permit the air-borne particulates to be deposited thereon.

After the desired specimens or samples have been obtained, the spools on which the webs or films are wound, may be removed and tests made of the air-borne particulates deposited thereon, to obtain data concerning various types of air-borne particulates.

Having thus described the invention, what is claimed is:

In a machine of the class described, a frame, a sampling head mounted on the frame, said sampling head embodying an upper movable section, a centrally located air inlet pipe connected with said upper section, partitions dividing the upper section into spaced parallel passageways, one of said passageways being in direct alignment with said air inlet pipe, an anvil, means for feeding a film strip between the upper section of the sampling head and said anvil said anvil being movable into contact with the upper section of the sampling head temporarily clamping a film strip between the upper movable section and anvil, means for feeding a film strip between the upper section of the sampling head and anvil, means for creating a suction of atmospheric air through said upper section of said sampling head directing air-borne particulates against said film strip operating through the passageways, and spools on which the film strip is wound providing a permanent record for analysis.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,212,450	Bunnell	Jan. 16, 1917
1,387,731	McVickar	Aug. 16, 1921
2,076,553	Drinker et al.	Apr. 13, 1937
2,076,554	Drinker et al.	Apr. 13, 1937
2,228,216	Morgan	Jan. 7, 1941
2,312,295	Dahlman et al.	Feb. 23, 1943

FOREIGN PATENTS

Number	Country	Date
659 of 1911	Great Britain	Oct. 12, 1911