Dec. 29, 1970 H. D. BOWEN ET AL 3,550,357

SEPARATOR HAVING ADJUSTABLE LOWERS WITH CLEANING MEANS THEREFOR

Filed June 13, 1968

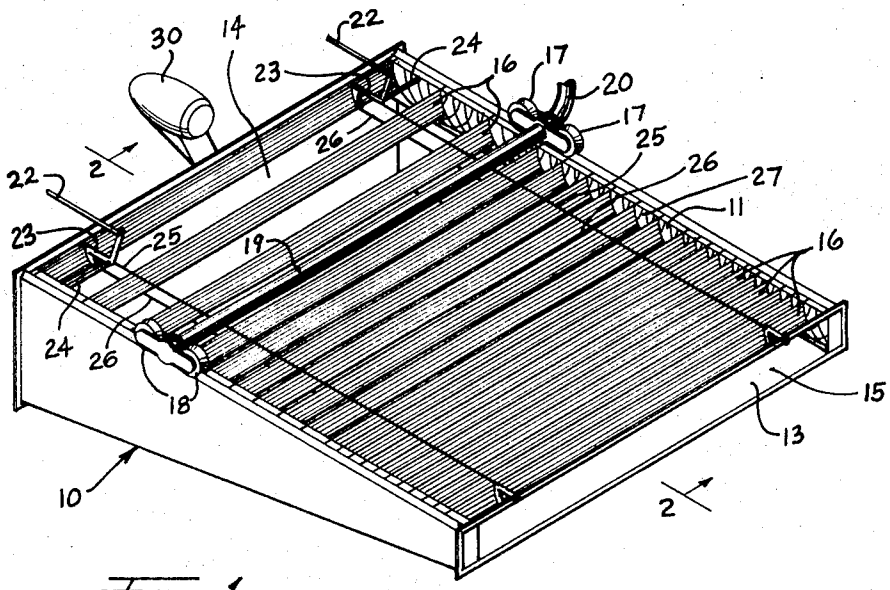

Fig 1

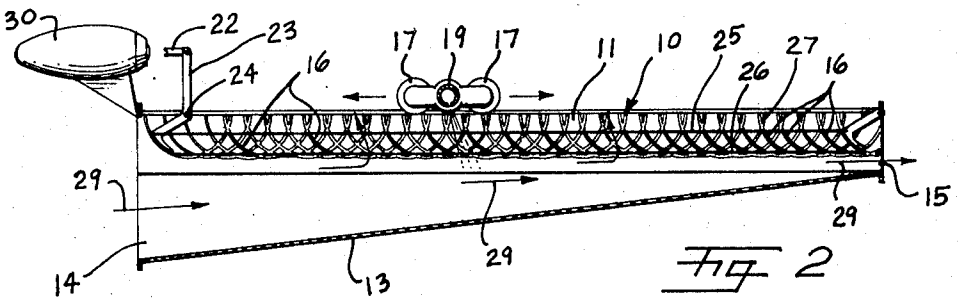

Fig 2

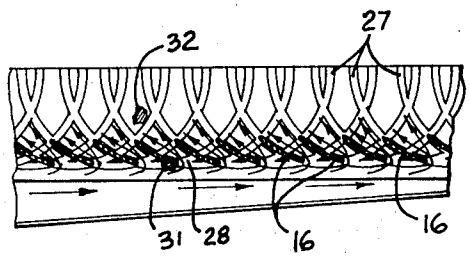

Fig 3

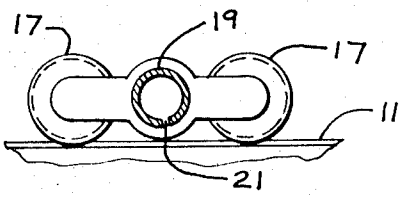

Fig 4

HENRY D. BOWEN
CHARLES P. STANLEY, JR.
INVENTORS.

BY John G. Mills

ATTORNEY.

United States Patent Office 3,550,357 Patented Dec. 29, 1970

3,550,357

SEPARATOR HAVING ADJUSTABLE LOUVERS WITH CLEANING MEANS THEREFOR

Henry D. Bowen, 2200 Charlotte Court, Raleigh, N.C. 27607, and Charles P. Stanley, Jr., Raleigh, N.C.; said Stanley assignor to said Bowen

Filed June 13, 1968, Ser. No. 736,738
Int. Cl. B01d 53/30
U.S. Cl. 55—270 3 Claims

ABSTRACT OF THE DISCLOSURE

A device for separating particles from an air stream, the device having a plurality of elongated, curved cross section, adjustably mounted louvers. Said device having a means to clean the louvers.

DESCRIPTION

This invention relates to separating devices and more particularly to devices for separating particles from an air stream through the use of a multiplicity of louver means.

In the past, it has been found that highly polluted air streams can be partially cleansed and the air borne particles therein concentrated by placing a multiplicity of slants or louvers adjacent such air stream to allow the air to escape therebetween while the particles, because of their momentum, continue to move longitudinally through the unit.

Various forms and configurations of supporting structure, along with varying arrangements of louvers, have been used both commercially and experimentally in an effort to prevent fewer particles from escaping in the air stream passing between the louvers as well as to increase the efficiency of operation when dealing with relatively small particles. None of these prior art devices, however, have been able to remove over ninety per cent of all air borne particles the size of bran and smaller. Also none of the prior art devices have been able to retain fifty per cent or more of the fine particles ranging between 10 and 20 microns in diameter which is approximately the size of finely ground flour.

After much research and study into the above mentioned problems, the present invention has been developed to provide a highly efficient, louver type particle concentrating and air cleaning separator which will allow maximum air exhaust with minimum particle escape. This invention is also designed to allow maximum effective operation under varying use conditions and automatic adjustment to varying conditions as they develop.

It is an object, therefore, of the present invention to provide a louver type separating device including a multiplicity of elongated, curved in cross section, louvers for separating impurities from an air stream.

Another object of the present invention is to provide a louver type separating device having a means for adjusting the distance between the louvers for optimum operation under the then existing conditions of air velocity, concentration of pollution, and the like.

A further object of the present invention is to provide a means for automatically adjusting the distance between the louvers of a louver type separating device for maximum air exhaust with minimum pollution escape under the then existing conditions.

Another object of the present invention is to provide a series of louvers in a separating device wherein the width of the escape opening adjacent the air stream may be made smaller while maintaining a constant width between adjacent louvers on the exhaust side thereof.

An additional object of the present invention is to provide a cleaning means for the louvers of a louver type separating device.

Other objects and advantages of the present will become apparent and obvious from a study of the following description and the accompanying drawings which are merely illustrative of the present invention.

In the drawings:

FIG. 1 is a perspective of a preferred embodiment of the present invention;

FIG. 2 is a sectional view taken through lines 2—2 of FIG. 1;

FIG. 3 is an enlarged sectional view of part of the louvers of the present invention showing the air distribution therethrough; and

FIG. 4 is an enlarged sectional view of one form of cleaning means for the louvers.

With further reference to the drawings, a wedge shaped separator housing indicated generally at **10** is composed of a pair of parallely disposed trapezium shaped side walls **11** and **12** and a bottom **13**.

The entrance end **14** and the particle exit end **15** of the separator housing **10** are both open.

Extending across the upper open portion of the separator housing **10** and slideably mounted in a series of curved slots **27** along the upper edge of walls **11** and **12** as oriented in the drawings are louvers **16** which are also curved when seen in cross section.

Operatively mounted to ride on the upper edge of each of the side walls **11** and **12** are respectively pairs of grooved rollers **17** and **18**. Rotatively mounted on these rollers is an elongated hollow cleaning conduit **19**. A flexible pipe or hose **20** is connected to one end of conduit **19** and the other end of such conduit is closed. As will be noted, particularly from FIG. 4, a downwardly disposed opening or orifice **21** is provided which extends from the area adjacent rollers **17** to the area adjacent rollers **18** to clean the louvers **16** and to remove buildups or globs of particles as will be hereinafter described in more detail.

Control arms **22** are pivotably mounted to brackets **23** which is pivoted about fixed points **24**. The lower end of brackets **23** opposite control arms **22** are secured to the louver adjacent entrance end **14**. Upper rods **25** and lower rods **26** are operatively connected to brackets **23** on opposite edges of said last mentioned louver. Each of these rods are connected to each of the louvers **16** of the separating device of the present invention so that all of said louvers may be slideably moved in their curved mounting slots **27** to either widen or narrow the entrance areas **28**.

As can be noted from the figures, if the louvers are moved into a position generally parallel to the air flow **29** therethrough, the upper portion of such housing will virtually become closed with very little, if any, air escaping between the louvers. On the other hand, if such louvers are rotated 90 degrees to be disposed generally perpendicular to the longitudinal air flow, the upper portion of the separator housing will be virtually completely opened. There is somewhere between these two extremes the most advantageous louver angle for maximum particle retention with maximum air exhaust under existing operating conditions of the unit. Thus it can be seen that a great advantage can be obtained by producing a louver type separator having louvers which are angularly adjustable.

If desired, an automatic monitoring device can be set up for operation in conjunction with the separator of the present invention. One way of accomplishing this is to mount a photoelectric cell such as the one indicated at **30** at some convenient point so that it will beam across the area adjacent the exhaust side of the louvers **16**. With

proper design, this photoelectric sensing means can be so adjusted that when a predetermined concentration of particles are escaping with the air being exhausted between the louvers, a means (not shown) such as that disclosed in Pat. No. 3,308,873 to Dotto will automatically activate control arm **22** to close the distance between the louvers and thus the entrance area **28** until the concentration is reduced to a predetermined acceptable level.

OPERATION

In actual use of the unit of the present invention, a particle polluted air stream is directed through the open end **14** into the interior of the separator **10**. As this stream pases through the separator between 90 and 95 percent of the air will turn and escape between the louvers as indicated by the arrows in FIGS. 1, 2 and 3. Since the volume of air is reduced as part of it escapes, the cross section size of the device can be reduced to form a tapered, wedge-shaped trough with an inlet end ten times larger in cross section area than its opposite exit end. The air borne particle cannot change direction of travel as quickly nor sharply as the air thus such particles tend to continue in a straight line through the separator and out exhause end **15**. Some of the particles, of course, will contact the louvers but since they are curved downwardly and toward the exhause end of the unit, these particles will normally impinge off of the louvers back into the stream flowing longitudinally through the unit.

It has been found that deposits of very fine flour size particles will collect in the eddy space created by the separation of air flow going out through the louvers and passing longitudinally through the separator. This is particularly exemplified by the arrows in FIG. 3. When using the straight louvers of the prior art devices, these accumulated deposits will build up until they break loose either by themselves or are forced loose by vibration or other means. They are then caught in the flow of air passing between the louvers and are blown out of the system. The reason this happens is that flat louvers necessarily must be disposed parallel to each other which causes the velocity and air pressure as the stream enters the area between the louvers to be the same as the velocity and air pressure as the air leaves such area. In applicant's device, on the other hand, the area between the louvers is divergent with the louvers being their closest at their interior edges. When a buildup or deposit **31** breaks loose and becomes a composite air borne particle **32**, it will be carried upwardly by the air stream passing between the louvers until the air pressure is sufficiently reduced by the widening distance between the louvers that gravity counteracts the particles' movement. Thus it can be seen that the composite particle will reach a static point at which it will neither be blown from the device nor will it fall back into the interior thereof.

Since the composite particles **32** may tend to erode while being suspended in the air stream flowing between the louvers, a means such as hollow conduit **19** may be operatively mounted so that it can be moved, either manually or automatically longitudinally back and forth (by means not shown) above the louvers blowing a stream of compressed air (from a source not shown) therebetween. This stream of cleaning air is not only strong enough to overcome the outward escaping air flowing between the louvers and force all of the floating particles **32** back into the interior of the separator, but it also breaks the built-up deposits **31** from their attached positions.

If it is found during operation that more particles are escaping between the louvers than is desired, a means (not shown) may be activated to move levers **22** which, through the linkages, brackets and pivot points rotate the louvers downwardly in their slots **27** until the desired narrower spacing between such louvers' interior edges is obtained. This gives better separating results although it does cut down on the volume of air escaping. When conditions change, such as less polluting particles or larger particles, in louvers can be rotated upwardly to increase the distance therebetween with resultant increase in volume capacity. If automatic operation of the louver rotation is desired, a sensing means such as photoelectric cell **30** can be used to control the activating means (not shown). The many advantages of this type operation are obvious since constant results are assured.

In view of the fact that the air of a polluted air stream tends to escape through the course of least resistance and further in view of the fact that the straight line velocity of the polluting particles is at its highest as they enter the separator through the open end **15**, fewer louvers are required in this area than are required adjacent the exhaust end **15** where the particles are more susceptible to being caught in the escaping air flow between the louvers due to their reduced velocity. By having this increasingly narrower spacing between the louvers as viewed from entrance to exhaust end adds to the efficiency of operation of applicant's device.

In addition to the numerous other advantages of the present invention as hereinabove enumerated, it has the additional advantage of allowing the louvers to be of much thinner construction than has heretofore been possible using flat louvers. This, of course, is due to the inherent stiffness obtained from the elongated, semicircular cross section configuration.

To prevent or greatly reduce the instant of concentrated particle buildup, the louvers can be coated with a non-adherent material such as fluorocarbon resins produced by e.i., Du Pont de Nemours & Co. and sold under the trademark "Teflon." To the contrary, if it is desired to catch and retain extremely fine particles with a diameter of only a few micron, an adhesive can be applied to at least a portion of each of the louvers.

Although a groove wheel carrier is shown in the drawings, it is obvious that other types of moving air blast arrangements could be developed. Also it is to be understood that an automatic means could be provided for slowly moving the air blast means back and forth from one end of the separator to the other so as to maintain the louvers at all times in relatively cleaned condition.

It is obvious that the present invention has the advantage of being simple in construction and operation while being inexpensive to manufacture. It is also structurally strong, automatic, controllable and highly efficient in percentage of separation.

The terms "top," "bottom," "upper," "lower" and so forth have been used herein merely for convenience in the foregoing specification and the appended claims to describe the separator and its parts as oriented in the drawings. It is to be understood, however, that these terms are in no way limiting to the invention since the separator may obviously be disposed in many different positions when it is in use.

The present invention may, of course, be carried out in other specific ways than those herein set forth without departing from the spirit and essential characteristics of the invention. The present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein.

What is claimed is:

1. A separating device comprising: an open ended housing composed of a pair of side portions connected along one edge by a bottom portion and along an opposite edge by a multiplicity of spaced, adjustable louver means of curved cross section slideably mounted in curved slots; a particle polluted air stream introduced into the interior of said housing through one of the open ends thereof; photoelectric means beamed across the area adjacent the louvers for monitoring the rate of particle escape in the air passing between said louvers; adjusting means operatively connected between said monitoring means and said louver means whereby the most advantageous angular louver adjustment may be automatically

maintained; means for removing buildup deposits of particles accumulated on said louvers including a source of pressurized fluid directed from the exterior through the louvers toward the interior of the separating device; and means for automatically passing the cleaning means back and forth across the louvers at predetermined time intervals whereby automatic control of escaping particle concentrations and deposit buildups can be accomplished.

2. The device of claim 1 wherein the louvers are coated with a nonadherent material.

3. The device of claim 2 wherein the nonadherent material is Teflon.

References Cited

UNITED STATES PATENTS

2,152,115	3/1939	Van Tongeren	55—344
2,759,410	8/1956	Hurt, Jr.	98—40(V)
2,780,308	2/1957	Mullin et al.	252—88X
2,878,892	3/1959	Field	55—440X
3,055,038	9/1962	Black, Jr.	15—312
3,308,873	3/1967	Dotto	160—176

FOREIGN PATENTS

1,130,971	10/1965	France	55—105
1,287,552	2/1962	France	55—447
284,790	12/1952	Switzerland	55—LOU

OTHER REFERENCES

"Soplasco Eliminator Blades," Southern Plastics Company, 408 Pendelton St., Columbia, S.C.; received in the Patent Office May 25, 1964.

Pulverizing Machinery "Bulletin FB–1," Division of Slick Industrial Company, Chatham Road, Summit, N.J., 07901; received in the Patent Office Nov. 27, 1967.

DENNIS E. TALBERT, JR., Primary Examiner

U.S. Cl. X.R.

55—283, 294, 302, 415, 417, 418, 440, 442; 98—40; 160—5, 11, 176, 205