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ACOUSTIC CURB FOR BUILDING-ROOF AIR EXHAUSTER

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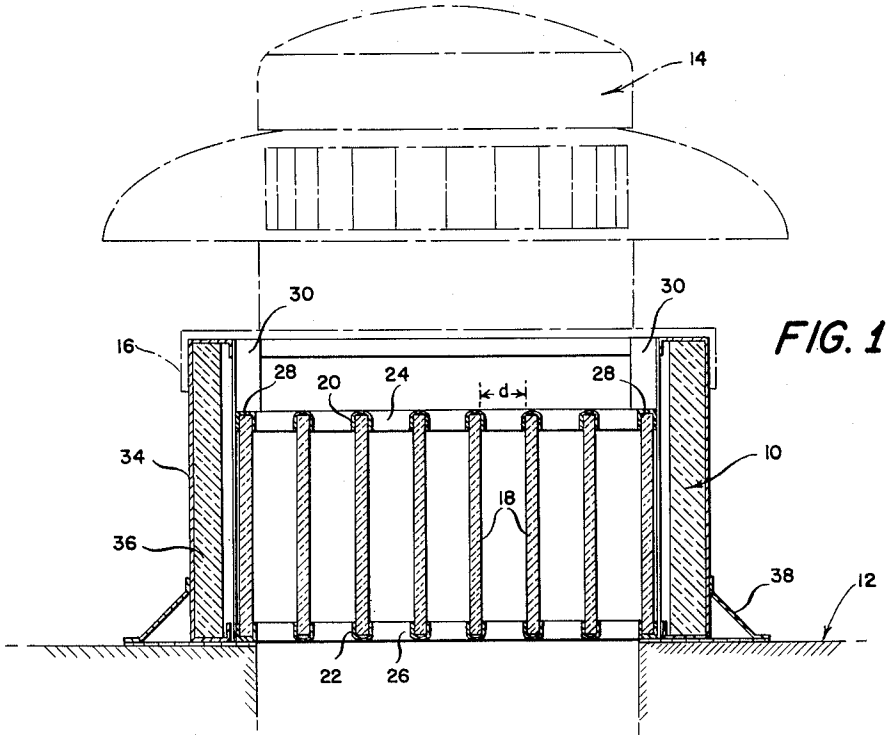

FIG. 1

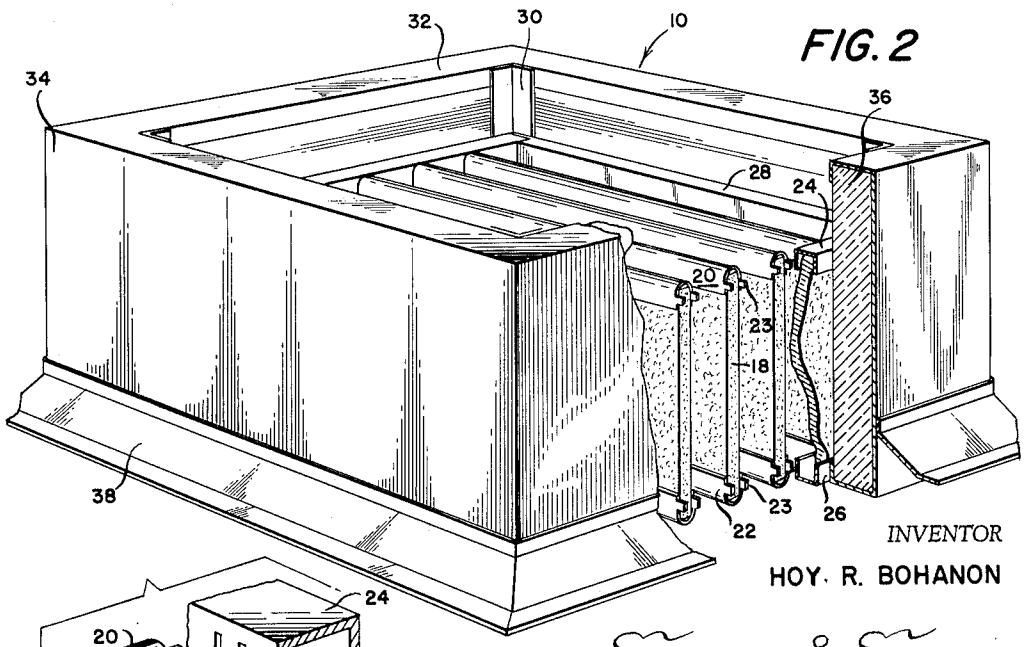

FIG. 2

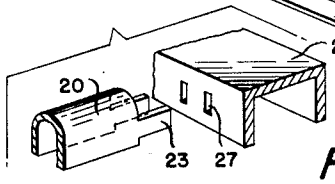

FIG. 3

INVENTOR

HOY. R. BOHANON

BY Semmes & Semmes

ATTORNEYS

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ACOUSTIC CURB FOR BUILDING-ROOF AIR EXHAUSTER

Hoy R. Bohanon, Muskogee, Okla., assignor to Acme Engineering and Manufacturing Corporation, Muskogee, Okla., a corporation of Oklahoma

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The present invention relates generally to an acoustic curb for use with power operated air exhausters. More particularly, the present invention relates to a prefabricated acoustic curb designed to support a centrifugal roof exhauster and to provide maximum sound attenuation with a minimum pressure loss.

The problem of reducing sound level has received increased attention from the ventilating industry with the advent of expanded application of power roof exhausters to large buildings such as hospitals, churches, auditoriums, libraries, schools and laboratories.

It may generally be said that the design of acoustical curbs involves two factors. Ideally, an acoustic curb should be designed to reduce noise level while maintaining minimum pressure loss or restriction to the flow of air passing through the curb. This restriction or loss in airflow, resulting from the use of an acoustic curb, may be illustrated by comparing a first fan with an acoustic curb at a given airflow with a second fan without such a curb at the same airflow. If, for example, the acoustic curb of the first fan reduces the fan airflow 20%, this will require a 25% increase in fan speed to produce the same flow rate present in the second fan. This, in turn, will increase the power requirements of the first fan by the cube of the speed or 95%. Also, the increased fan speed will enlarge the sound power generated by the fifth power of the speed, or an increase of 200%, thereby losing a considerable part of the acoustic gain of the curb.

The loss in airflow resulting from the use of an acoustic curb is comprised of two basic components. First, there is a pressure loss resulting from the resistance of flow of air passing through the curb itself. Accordingly, as the fan is required to develop increased pressure, its flow is reduced. This is an expected loss and can be calculated in the same manner as conventional losses in duct systems.

Importantly, there is a second loss that can be more significant than the expected loss resulting from the resistance of airflow through the curb. Since the elements of the acoustic curb are located in close proximity to the inlet of the fan, their presence may cause a disturbance in the flow pattern of air thus preventing the fan inlet from being completely filled with uniform velocity airflow. This disturbance in the flow pattern of air will, of course, disrupt the performance of the fan. The combined effect of these two factors is called "interference," as the acoustic curb actually interferes with the operation of the fan.

Acoustic curbs or sound attenuators are the subjects of the recently issued U.S. Patent Nos. 3,085,647 and 3,110,357 to L. J. Jenn et al. The constructions disclosed in these patents may be referred to as "center baffle" arrangements wherein a single baffle having a sound attenuating surface, or primary and secondary baffles having similar sound absorbing surfaces, are suspended within the curb so as to extend transversely across both the inlet and discharge apertures. Unfortunately, the use of such center baffle construction results in a substantial reduction in airflow rate largely because of the necessity of drastic changes in direction of airflow. That is, since the center baffle(s) is so close to the fan's inlet, the drastic changes in direction of the flow of air, necessary to navigate the tortuous path defined by the relationship of the baffle(s) to the inlet, creates an undesirable disturbance preventing the fan

inlet from being completely filled with uniform velocity air.

Accordingly, it is an object of the present invention to provide an acoustic curb characterized by maximum sound attenuation and minimum pressure loss.

Another object of the present invention is to provide an acoustic curb adapted for use with large, high capacity roof exhaust systems capable of effectively intercepting sound from such systems without increasing the pressure drop thereacross to objectionable values.

Still a further object of the present invention is to provide an acoustic curb for roof exhausters capable of eliminating the undesirable airflow losses present in center baffle arrangements with the use of a novel parallel sound absorbing plate arrangement.

Still another object of the present invention is to provide an acoustic curb for effectively reducing noise level from roof exhausters with a minimum loss of pressure with the use of a novel vertically aligned parallel sound absorbing plate assembly.

Finally, a further object of the present invention is to provide an acoustic curb of small, economical design having an overall dimension the same as that of the roof fan wherein a plurality of parallel, vertically disposed sound absorbing plates are held in spaced relationship by a simple frame assembly embodying a tab connection feature.

Still further objects of the present invention will become apparent form the ensuing specification and attached drawings, wherein:

FIG. 1 is a side elevation illustrating the acoustic curb in cross-section;

FIG. 2 is a perspective view of the acoustic curb broken to illustrate the novel parallel plate arrangement; and

FIG. 3 is an enlarged perspective view showing a preferred economical method of attaching the parallel sound absorbing plates to the frame assembly of the acoustic curb.

As seen in FIG. 1, the reference numeral **10** is used to generally designate the acoustic curb which is interposed between roof **12** and centrifugal exhaust fan **14**. Note that fan **14** terminates at the bottom thereof in curb cap **16** of the same overall dimension as the acoustic curb **10** permitting these elements to be joined in abutting relationship. Curb **10** is secured to roof **12** by conventional bracket **38**.

Located within acoustic curb **10** are a plurality of individual sound absorbing members or plates **18** which may, for example, be made from a rigid fiberglass type of material. Obviously, any kind of sound absorbing substance may be utilized in the manufacture of plates **18**. At the top and bottom portions of plates **18** are located metal nosing strips **20** and **22** which terminate at their end portions in tabs **23**, the purpose of which will be hereinafter set forth. It will be noted that nosing strips **20** and **22** are rounded to obtain better streamline flow. Also, adequate space between strips **20** and the inlet of fan **14** is provided to allow the flow of air to become smooth.

Nosing strips **20** and **22**, which function primarily as supporting means for plates **18**, are held in spaced relationship within acoustic curb **10** by frame members **24**, **26**, **28** and **30** which may be lined with acoustical material. As seen in FIG. 3, frame members **24** and **26** contain slots **27** through which the tabs **23** of nosing strips **20** and **22** are passed. Thereafter, tabs **23** are bent adjacent the inner channel portions of frame members **24** and **26** securing nosing strips **20** and **22** in place.

Since frame members **24**, **26**, **28** and **30** form an integral structure, the entire assembly of plates **18** may be removed from body portion **34** as a unit. As seen in FIG. 2, frame members **30** rest in abutting relationship against inner shoulder **32** of body portion **34**.

The sides of body portion **34** of curb **10** may, as illus-

trated in FIG. 1, be lined with an insulating material **36** which functions primarily to prevent condensation on the inside of curb **10** during cold weather but which also provides an additional layer of sound absorbent material at the edges of the assembly of plates **18**.

Although the spacing *d* between plates **18** is theoretically critical from an acoustical absorption viewpoint, in practice it is found to have little effect over the range of one to two inches. However, a spacing of between four to five inches would probably reduce the effectiveness considerably. It is preferred that plates **18** be one inch in width and spacing *d* be two inches. Although the height of plates **18** is important, their design is limited by the acceptable height of the entire curb assembly **10**. At present it is contemplated that plates **18** be twelve inches high when used with a sixteen inch curb.

Manifestly, numerous changes in the structure for supporting the parallel sound absorbing plates within the acoustical curb may be employed without departing from the spirit and scope of invention as defined in the subjoined claims.

I claim:

1. An air exhauster for a building having a roof with ventilating opening therein, comprising in combination: an acoustic curb having a base and top wall connected by a side wall, said base wall containing an inlet for air located in juxtaposition with respect to said ventilating opening of said roof while said top wall contains an outlet for air being exhausted through said curb; a frame assembly removably mounted within said curb, said frame assembly including upper and lower horizontal frame members mounted in sliding relationship within said curb, said frame assembly further including a plurality of upper and lower supports spaced apart from each other short horizontal distances along said upper and lower frame members and attached thereto, said upper and lower supports being generally U-shaped in configuration; a plurality of vertical sound absorbing plates having top and bottom portions secured within said U-shaped upper and lower supports respectively; and a power driven fan unit mounted upon said top wall of said curb for drawing air from said inlet to said outlet in a vertical path to move in the same direction as said sound absorbing plates and thus not be subjected to drastic changes in direction within said curb.

2. An acoustic curb to be attached at the top thereof to a power driven fan unit and at the bottom thereof to the roof of a building, comprising:

(A) a body portion having a base wall and a top wall connected by a side wall not exceeding sixteen (16) inches in length, said top wall containing an air outlet configured so as to rest in abutting relationship against said fan unit while said base wall contains an inlet for air from said building and means for attaching same to said roof;

(B) a removable frame assembly located within said body portion, said frame assembly including opposed side portions containing pluralities of slots therein, said frame assembly further including a plurality of upper and lower supports being generally streamlined in U-shaped configuration and spaced apart from each other short horizontal distances not exceeding four (4) inches along said opposed side portions, said U-shaped supports terminating in tab members, said tab members passing through said slots of said opposed side portions to secure said supports thereto; and

(C) a plurality of vertical, flexible sound absorbing plates having top and bottom portions secured within said U-shaped upper and lower supports respectively such that air passing vertically from said inlet to said outlet of said body portion moves in the same direction as said plates and is thus not subjected to drastic changes in direction within said body portion.

3. An air exhauster for a building having a roof with ventilating opening therein, comprising in combination: a body portion having a base and top wall connected by a side wall, said base wall containing an inlet for air located in juxtaposition with respect to said ventilating opening of said roof while said top wall contains an outlet for air being exhausted from said body portion; a frame assembly located within said body portion, said frame assembly including a plurality of upper and lower supports spaced apart from each other short horizontal distances along said frame assembly, said upper and lower supports being generally U-shaped in configuration; a plurality of vertical sound absorbing plates having top and bottom portions secured within said upper and lower U-shaped supports respectively; and a power driven fan unit mounted upon said top wall in covering relationship with respect to said outlet such that air moving from said inlet to said outlet in a vertical path moves in the same direction as said plates and is thus not subjected to drastic changes in direction.

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LEO SMILOW, *Primary Examiner.*