July 31, 1962 E. J. SHUSTROM 3,046,619

SHUTTER

Filed July 6, 1959

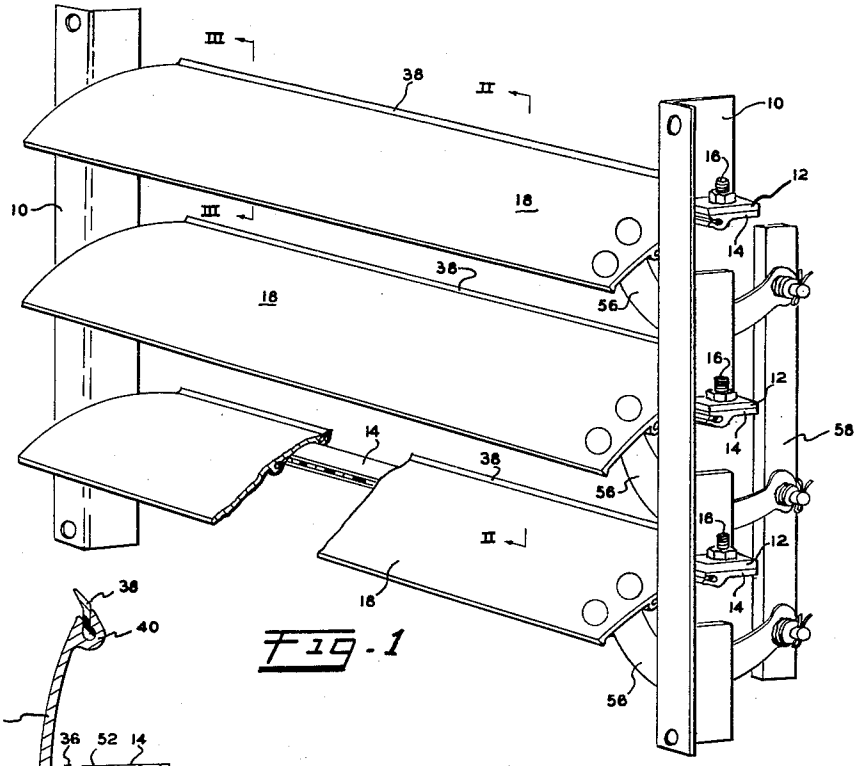


Fig. 1

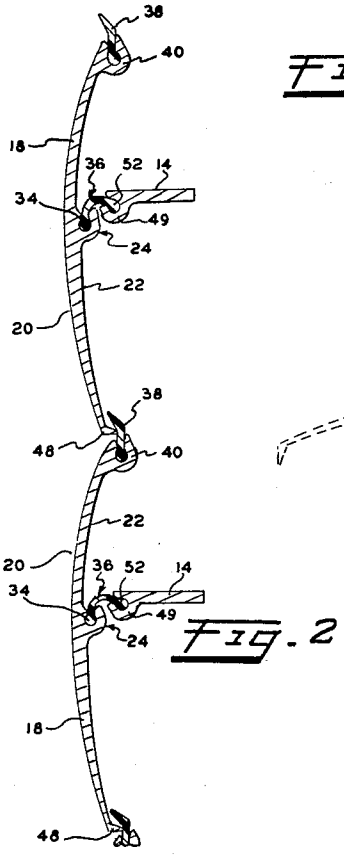


Fig. 2

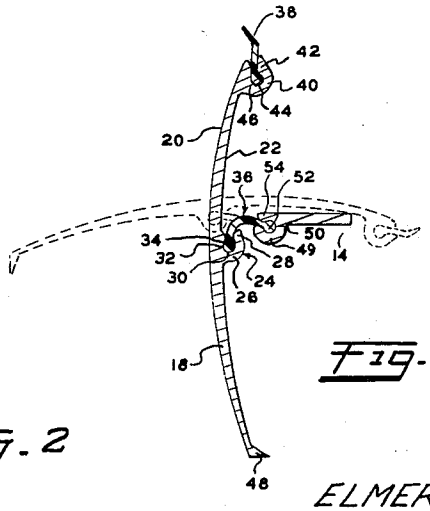


Fig. 3

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SHUTTER

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The invention relates to air or gas flow control apparatus and specifically pertains to devices of the parallel shutter type such as used with internal combustion engine radiators.

Shutters have long been used to control the flow of air or gases and have found wide usage in the ventilation art. A common use of such apparatus has been to control the quantity and direction of air flowing through the radiator of internal combustion engines and other ventilation devices on vehicles. In the past the shutter vanes have been supported by pivot shafts rotatably supported in a suitable bearing and often the bearing consists of no more than a hole formed in the shutter supporting framework. Because of the highly corrosive conditions caused by rain, salt and road chemicals, conventional vehicle mounted shutters usually corrode rapidly and because of the plurality of components involved and the infrequent seasonal operation thereof, the vane apparatus often becomes inoperative due to the formation of rust and the like at the hinge or pivot of the vane. Although it is sometimes possible to free corroded shutters with rust solvents and direct manipulation of the vane, the condition will become progressively worse and within a short period of time the shutters often become inoperative again.

To overcome the above disadvantages of conventional shutter construction, it is an object of the invention to provide a vane which is not supported by a pivot and bearing and which is not susceptible to becoming inoperative due to corrosion. To accomplish this objective the invention employs a vane hinge or pivot constructed of a flexible material which is relatively unaffected by water, salt and the like, yet provides a strong and accurate means for supporting the vane.

A further object of the invention is to provide a vane construction of extruded material which has a high resistance to bending and deflection.

Another object of the invention is to provide a shutter vane construction wherein sealing means may be readily assembled to the shutter and cooperation of the sealing means of the vane with the adjacent vane is positive and effective.

A further object of the invention is to provide a shutter vane construction for use with a flexible hinge wherein the vane may be hinged throughout its entire length.

Another object of the invention is to provide a shutter apparatus which is dependable in operation and may be readily manufactured and assembled.

These and other objects of the invention arising from the details of construction of an embodiment thereof will be apparent from a description of the accompany drawings wherein:

FIG. 1 is a perspective view of a three vane shutter apparatus in accord with the invention wherein a portion of the lower vane is cut away to illustrate the hinge support,

FIG. 2 is an elevational, sectional view of the vanes shown in the closed position as taken along the line II—II of FIG. 1,

FIG. 3 is an elevational, sectional view of an enlarged detail of the vane construction taken along the line III—III of FIG. 1.

It will be appreciated that although the shutter construction of the invention was primarily intended for use with vehicle radiator cooling and ventilation systems, the

construction is not limited to such application and may be used in most conventional shutter installations.

Referring to FIG. 1, the shutter structure may include a pair of parallel spaced angle elements **10** which, in an installation, would be affixed to the vehicle structure. The angle elements **10** may be cut and formed to provide a plurality of ears **12** which extend at right angles from the inside legs of the elements **10**. A plurality of extruded cross members **14** are interposed between elements **10** and are affixed to the ears **12** by bolts **16** extending through holes formed in the ears and cross members. The cross members **14** constitute the support elements for the vanes **18** and the members **14** extend at right angles to the elements **10** and are spaced apart a distance proportionate to the width of the vanes as will be later apparent. It will be understood that the angle elements **10** and cross members **14**, as assembled, will define a rigid structure which may be readily affixed to the vehicle or other primary structure.

The vanes **18** are preferably formed of extruded material such as aluminum which is resistant to corrosion and will maintain an attractive appearance over long periods of time. The length of the vanes will depend on the width the elements **10** are spaced apart, which distance is determined by the size of the opening to be shuttered. It is one of the features of the construction of the invention that extremely long vanes may be employed without appreciable sacrifice of strength characteristics and that a minimum of supporting structure is required to mount long vanes for "flutter-free" operation.

The details of the vane construction are best illustrated in FIG. 3 wherein the general arcuate configuration is readily apparent. The outer surface of the vane **18** is designated **20** and this surface is smooth and uninterrupted as is apparent from FIG. 1. The inner surface **22** is also of an arcuate form, somewhat similar to that of the outer surface **20**. However, formed projections are provided on the inner surface to facilitate the attachment of the hinge and sealing lip to the vane. The inner surface **22** is formed with an approximately centrally located projection **24** that extends the length of the vane and is parallel thereto. The projection **24** has a minimum thickness at **26** and an enlarged head at **28**, which form half on an arcuate recess **30** between the projection **24** and main body of the vane. The other half of the recess **30** is defined by an arcuate depression **32** formed in the vane which also extends the length of the shutter. The recess **30** is thus of a generally cylindrical configuration and will receive the bulbous, cylindrical edge **34** of a flexible hinge **36**. After the edge **34** is placed within recess **30**, the projection **24** is bent toward depression **32** to firmly grip the hinge edge **34** and facilitate a mechanical connection between the hinge **36** and vane **18**.

The upper edge of the vane, FIG. 3, is provided with a sealing lip **38** of a flexible material such as neoprene, rubber or the like and the lip is connected to the vane by a mechanical connection similar to that used to grip the hinge. A projection **40**, extending the length of the vane, is formed with a head **42** and defines a cylindrical recess **44** into which the cylindrical edge **46** of the lip **38** is received. After edge **46** is placed within recess **44** bending of the projection **40** toward the outer surface **20** will securely grip the lip and a sealed connection between the vane and lip is produced. It will be appreciated that the projections **24** and **40** are illustrated in FIG. 3 in the deformed positions wherein the gripping of the hinge and sealing lip is provided.

The lower end of the vane **18** is formed with an inwardly projecting edge **48** which extends the length of the vane and connects with the sealing lip as will be apparent in the description of FIG. 2.

The edge of the cross members **14**, adjacent the vanes, is also formed with means for gripping the hinge **36** and takes the form of a projection **49** which defines a cylindrical recess **50** within the edge of the cross member. The hinge **36** is provided with a second bulbous cylindrical edge portion **52** which is received within recess **50** and deflection of the projection **49** toward the cross member edge **54** will solidly connect the hinge to the cross member **14**. It will be noted that the enlarged end of the projections **24** and **49** is formed as to provide contact over a substantial portion of the hinge adjacent the cylindrical edges thereof. This construction prevents the projections from cutting or excessively pinching the hinge in the flexing portion of the hinge.

It will be understood that the hinge **36** consists of an elongated piece of flexible material such as neoprene, rubber, plastic, leather or the like having substantially cylindrical edge portions which are gripped by the vane and cross member structure. The hinge portion of reduced thickness between the edges **34** and **52** is highly flexible and it is preferred that the hinge material be relatively non-elastic whereby the vanes are supported for easy pivotal action yet will not shift an objectionable degree with respect to the cross members. It will be understood that in the preferred embodiment the hinge **36** extends the entire length of the vanes. The degree of flexing of the hinge and relation of the vane to the cross member when the vane is full open is shown by the dotted lines of FIG. 3.

The structure for operating the position of the vanes may be of conventional nature and consist of an arcuate activator arm **56** affixed to each vane **18** by rivets or other suitable means. The free ends of each of the arms **56** is pivotally affixed to a common connecting bar **58** by a pivot pin and a control mechanism, not shown, adapted to axially translate bar **58** will thus simultaneously pivot all of the vanes **18** in the known manner. While the activator arms **56** are illustrated as affixed adjacent the end of the vanes the arms **56** may be affixed to the vanes at any axial position and in many cases would be centrally located between the vane ends.

The relation of the vanes **18** in the closed position is shown in FIG. 2. The cross members **14** are spaced apart a distance related to the width of the vanes such that the vane edge **48** will engage the sealing lip **38** of the vane below. It will be noted that the lip **38** is formed to curve forwardly and engagement with the edge **48** is such as to slightly bias the lip backward and a substantially air tight seal is produced. Since the metallic portions of the vanes do not engage each other, leakage due to foreign matter getting between the shutters and preventing the vanes from completely closing is minimized.

From the above description it will be apparent that the invention described a shutter construction that will not be subject to seizing due to corrosion and which is capable of achieving an accurate control of the air flow through the vanes. The arcuate shape of the vanes and the axially extending projections **24**, **40** and **48** provide thin wall construction of relatively high strength and resistance to bending and the lengthwise support of the shutter by the flexible hinge gives additional strength to the vane and minimizes "flutter." It will be noted from FIG. 2 that the hinge **36** is flexed the greatest extent when the shutters are closed and the least extent when open. Due to the tendency of the hinge to seek the unstressed condition the hinge functions as a spring to urge the vanes toward the open position and this feature provides a safety function in the event of a failure of the shutter control apparatus. Should a pivot pin or linkage become accidentally disconnected the vane will automatically assume an open position and possibly prevent overheating of the vehicle engine.

Modifications to the described embodiment may be apparent to those skilled in the art without departing from the spirit of the invention and it is intended that the invention be defined only by the scope of the following claims.

I claim:

1. In a shutter construction, a supporting framework including an elongated vane supporting member, an elongated vane having a pair of parallel longitudinal edges, a hinge of flexible material having a pair of longitudinally extending edges, one of said hinge edges being mounted on said member and the other hinge edge being affixed to said vane at a location substantially centrally located between and parallel to said vane edges, said hinge being of a length substantially equal to the length of said vane and continuously affixed throughout its length to said member and vane.

2. In a shutter construction, a supporting framework including an elongated vane supporting member, a vane of thin material having parallel longitudinal edges, a projection formed on said member defining an elongated support member recess, a projection formed on the vane the axial length thereof substantially centrally between and parallel to said vane longitudinal edges defining an elongated vane recess, an elongated hinge of flexible material of a length substantially equal to that of the vane and having bulbous edge portions and a flexing portion intermediate said edge portions, one of said edge portions being received and maintained within the support member recess and the other edge portion being received and maintained within the vane recess whereby said vane is pivotally mounted throughout its length upon said support member.

3. In a shutter construction, a supporting framework including an elongated vane supporting member, a recess defined in said member extending the length thereof, an elongated vane having a pair of parallel longitudinal edges, a recess defined in said vane substantially parallel to and centrally between said edges and extending the length of said vane, an elongated hinge of flexible material having a pair of longitudinal edges and of a length substantially equal to that of said vane, one of said hinge edges being fixedly receoived throughout its length within said supporting member recess and the other hinge edge fixedly received throughout its length within said vane recess.

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