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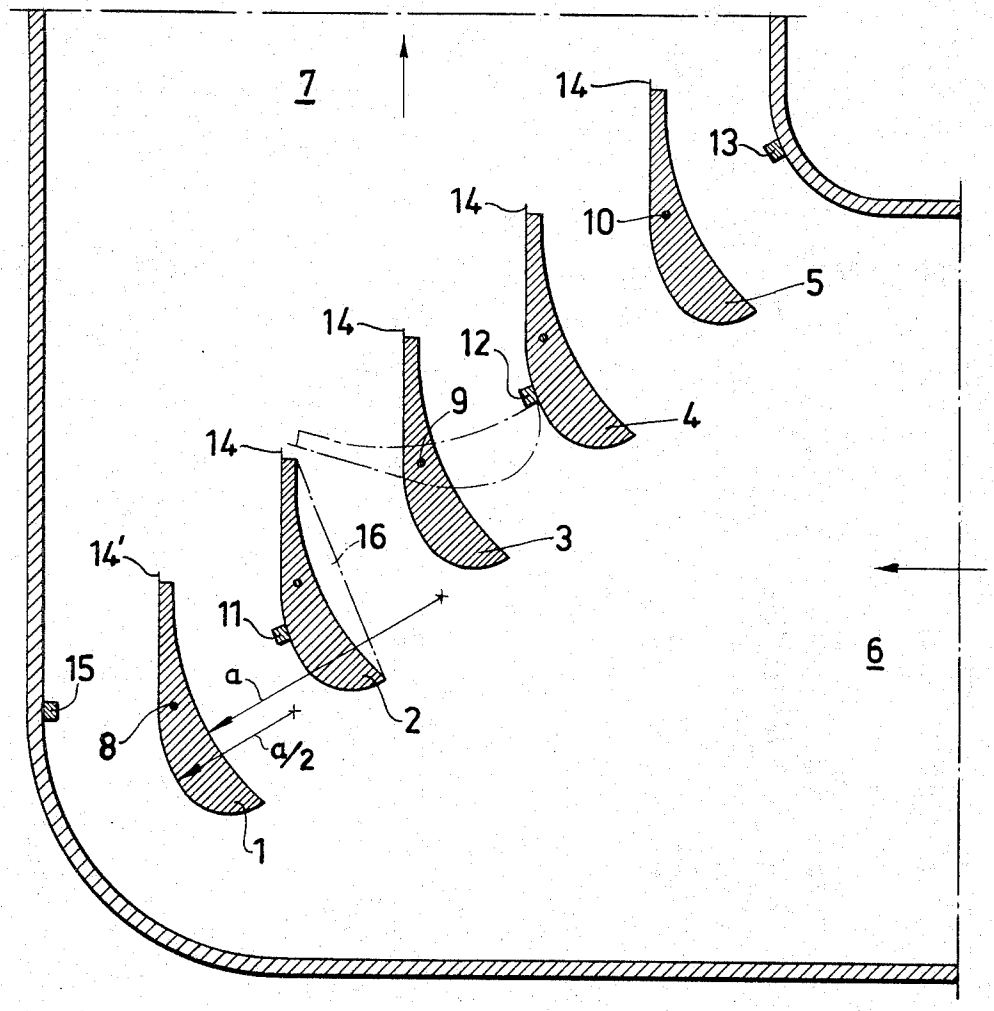

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VALVE STRUCTURE ADAPTED TO BE ARRANGED IN A FLUE BEND

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ABSTRACT OF THE DISCLOSURE

A valve structure consisting of a plurality of parallel straight vanes is located in the bend of a duct to control flow through the duct; alternate vanes being mounted for rotation between open and closed positions about axes that are parallel to and spaced inwardly of the longitudinal edges of the rotatable vanes; the axes being so located with respect to the cross sectional shape of the vanes and the cross sectional shape of the vanes being such that very little torque is required to effect their adjustment, and very little force is needed to hold them in any adjusted position.

This invention relates to a valve structure which is adapted to be arranged in a flue bend, for example in a flue of a heating boiler. The invention is characterized by one or more pivoted control means serving at the same time as guide vane means and as valve means, said pivoted control means, in a plane parallel to the direction of flow, having such a cross section shape that when said valve structure is fully open the free cross sectional area of the flue is essentially constant in the direction of flow, by which the flow losses are reduced as compared with flue bends without such a guide vane means, on one hand, and as compared with valves arranged in straight flues, on the other hand. In the flue there may also be arranged one or more stationary control means. Preferably the control means are alternatingly arranged stationarily and rotatably.

The pivoted control means may be so journaled and have such a cross section that the torque produced by the flow and acting on each pivoted control means is essentially balanced. This effect can be obtained in many ways. Essential is, inter alia, the design of the front—viewed in the direction of flow—edge of the pivoted control means. A construction which gives such a balancing within the greater part of the control range, is characterized in that the pivoted control means are journaled downstream of the largest cross sectional area of the flue bend, and in that the control means are defined by a concave and a convex surface, the radius of curvature of the concave surface facing the inner surface of the flue bend being essentially twice as great as the radius of curvature of the other surface.

The invention is hereinafter described in detail with reference to the accompanying drawing, which, by way of example, discloses a valve construction according to the invention.

The valve structure disclosed in the drawing is provided with five control means **1** to **5** serving at the same time as guide vane means and valve means, and it is arranged in a flue bend between a horizontal flue **6** of a heating boiler and a vertical flue **7** of said boiler. The control means **1**, **3** and **5** are rotatably mounted at **8**, **9** and **10** respectively, whereas the means **2** and **4** are stationarily mounted. Due to the offset (downstream) journaling of the pivoted control means and due to the fact that said pivoted control means are defined substantially by a concave and a convex surface with the radii of curvature *a*, and *a*/2 respectively,

a balancing of the forces generated by the flow is achieved. The concave surfaces facing the inner surface of the flue bend have thus twice as great a radius of curvature as the convex, outwardly facing surfaces. In the example shown, all control means have, for the reasons of manufacture, been made equal, i.e. with the same radii of curvature *a* and *a*/2. Next to the front edge the radius of curvature of the convex surface is less than *a*/2, which gives a still more improved balancing. In order to obtain the best possible flow conditions it may, however, sometimes be suitable to design the control means with radii increasing from the inner surface of the flue bend and outwards. On the stationary control means **2** and **4** there are mounted stops or sealing rims **11** and **12**. A similar stop **13** is mounted on the inner wall of the flue bend. As indicated at the intermediate control means **3** in dash and dot lines, these stops **11** to **13** cooperate with the front part of the concave surfaces of the movable control means. At the rear—viewed in the direction of flow—edge of the control means elongations **14** of the convex walls of the control means **2** to **4** will contact each other when the valve is being completely shut. The elongation **14'** on the control means **1** will thereby contact a stop or sealing rim **15** which is mounted on the outer surface of the flue bend. In the drawing there is finally shown in dash and dot lines how the control means may be stiffened by means of end plates **16**.

The invention is not limited to the example described above but may be varied within the scope of the appended claims. For example, the invention is not adaptable only to flues of heating boilers. Essential advantages may, of course, also be gained if the construction according to the invention is used for example in coarse water conduits of turbines or the like. Furthermore, the shape of the control means may be varied to some extent from the 2:1 ratio of concave to convex surface radii mentioned above, without departing from the idea of the invention. Essential is only that the greater part of the cross section increase obtained by the curvature of the flue is filled up with the control means serving as guide plates as well as valves. A construction is also possible where this filling up is obtained to the greatest part only by the stationary or only by the movable control means. The elements **11** to **15** may either be arranged only to serve as stoppers or they may be so designed that they also provide for an effective sealing when the valve is being shut. Further modifications are, of course, also possible within the frame of the invention.

What I claim is:

1. In combination with a duct along which fluid is adapted to flow, valve structure for controlling flow of fluid along said duct, said valve structure requiring substantially small forces for actuation to open and closed positions and when in its open position producing negligible resistance to flow of fluid along said duct, said valve structure comprising:

(A) means defining an abrupt bend in the duct, substantially straight portions of the duct being upstream and downstream from said bend defining means and a portion of the bend defining means intermediate its connections with said substantially straight portions having a cross section area greater than that of said upstream and downstream straight portions of the duct;

(B) a plurality of elongated vanes, each having a concave surface and a generally opposite convex surface, the radius of curvature of said concave surface being on the order of twice that of the convex surface so that each vane has substantial thickness, and said surfaces of each vane being convergent towards parallel lengthwise extending leading and trailing edges of the vane, the portion of the convex surface that is

near the leading edge of the vane having a substantially smaller radius of curvature than the remainder thereof; and

(C) means mounting said vanes in spaced apart parallel relation in said bend defining means and providing for rotation of certain of the vanes about axes which are parallel to their leading and trailing edges and intermediate them and which are located in said bend defining means slightly downstream from the portion thereof of largest cross sectional area, said mounting means disposing the vanes, when the valve structure is open, with their concave surfaces facing the bend and their leading edges upstream relative to the direction of fluid flow through the duct, and providing for rotation of said vanes toward their closed positions in the direction to dispose their convex surfaces upstream.

2. The valve structure of claim 1, further characterized by:

the radius of curvature of said surfaces of the several vanes being such that when the valve structure is in its fully open position the free cross section area at said bend is substantially equal to that of the duct upstream and downstream therefrom.

3. The valve structure of claim 1, further characterized by:

said mounting means holding alternate vanes across the duct stationary and providing for rotation of the remainder of the vanes.

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