

Description

[0001] The present invention relates to a fire damper for use in an air flow duct, and to a damper which can be used to regulate the flow of air in the duct.

[0002] Dampers in air flow ducts are well known. A commonly used form of damper consists of a flap inside the duct, which is held in an open position, extending along the duct axis. A heavy spring biases the flap to a closed position where it is transverse to the duct axis to block off the duct. A temperature sensitive trigger holds the flap in the open position and releases the flap in the event of a temperature rise caused by fire, such as a flame front moving through the duct. Typically, the flap is mounted on an axle extending across the duct, and a handle may be provided on the axle end outside the duct to enable an operator to return the flap to the open duct position.

[0003] As well as or instead of manual operation, such flaps may be fitted with a motorised control. One leading supplier of such motors is Belimo (www.bellimo.com/pdf/FireAndSmoke.pdf). A DC motor is fitted on the duct housing, over an exposed end of the flap axle. Usually the operation is 'normally closed', so that the motor is actuated to open the flap, and loss of power allows the flap to close under the force of the return spring. Other arrangements are possible, for example for smoke extraction in the event of a fire a flap may be closed by the motor and power removed to open the flap.

[0004] A problem arises with the mounting of the electric motor on the shaft end. Usually the shaft is of round cross-section, whereas a square section shaft is wanted for connection to the motor via a socket driven by the motor.

[0005] A first aspect of the present invention provides a fire damper in a ventilation duct, the damper comprising a flap which is pivotably mounted in the duct for movement from an open position, allowing air flow along the duct, to a closed position to inhibit air flow or the passage of flame along the duct, the flap is pivotally mounted on a round cross section axle which extends through the duct wall and a motor is mounted on the end of the axle for rotation of the flap, the motor having a polygonal socket for receiving the shaft end, wherein a protuberance is provided on the shaft surface for engagement with the socket wall to cause the axle to rotate with the socket.

[0006] The protuberance may extend into an angle or corner formed between two sides to the socket.

[0007] Preferably, protuberances are provided substantially diametrically opposite one another on the shaft.

[0008] A protuberance may be formed by a pin which is positioned in a bore in the shaft. The end of the pin distal of the shaft may be tapered.

[0009] The pin may extend through the shaft, forming protuberances on opposite sides of the shaft. Preferably the pin is angled where it leaves the shaft, and directed

lengthways of the shaft. The pin may pivot relative to the shaft.

[0010] It has been found that with this arrangement the alignment between the socket and pin is less crucial, the protuberance providing something of a universal joint to take up misalignment of the shaft and socket, particularly where the protuberance is pivotable relative to the shaft.

[0011] Other aspects and preferred features of the invention will be apparent from the following description and the accompanying claims.

[0012] The invention will now be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows schematically in cross-section a flap in an air flow duct;

Figure 2 is a view on arrow A of Figure 1;

Figure 3 is schematic view of a motor unit;

Figure 4 is an end view of a drive socket of the motor unit of Figure 3 and illustrating one embodiment of the invention;

Figure 5 is a perspective view of another embodiment of the invention, and

Figure 6 shows the embodiment of Figure 5 in a socket.

[0013] Figures 1 and 2 show duct wall 2 which is circular in cross-section. A continuous circular rim 4 having an inwardly extending flange 6 is riveted to the duct wall 2 at several positions around the rim by sealed rivets (not shown). The rim 4 has a step 8, to form a wall portion 10 which is spaced from the duct wall 2. The rim serves to provide a mounting and a stable mating surface for a flap or blade 12, and also strengthens the duct to maintain the duct shape in the region of the flap 12 to provide improved operation.

[0014] The flap or blade 12 is pivotably mounted on the rim 4 and is shown in full outline in its closed position, and in dotted outline in the open position.

[0015] As seen in Figure 1, the blade is stepped or joggled at a diameter region 12a so that the halves of the flap 12b, 12c occupy planes to either side of and parallel to the plane of the flange 6, when the flap is in the closed position.

[0016] Referring to Figure 2 the flap 12 is mounted on an axle 14 which rotate in a blind socket 16a formed on the rim 4 at one end 14a and extends through a sleeve 16b in the duct wall at the other end 14b. The axle 14 is a good fit in the socket 16a and sleeve 16b to reduce any tendency of the flap to wobble, and also to provide a degree of sealing against the passage of smoke when the flap is closed.

[0017] Heavy duty, i.e. strong, coil springs 18 surround the axle 14, and have one leg 20 bearing on the flange 6, and the other leg 22 bearing on the flap 12 to bias the flap into the closed position, against the flange 6.

[0018] The flap 12 is cut away at the edge 12e of the diameter region 12a, near the axle 14, to just clear the flange 6.

[0019] The flap 12 is overturned at its outer perimeter to form an axially extending flange 12d and a corner 12f to embrace the rim at the corner 11 formed at the radially outer edge of the flange 6 in portion 12c, and sit snugly at the corner 11 formed between the flange 6 and wall 10 at flap portion 12b. The flange 12d serves to strengthen the flap 12 to retain the shape of the flap during repeated operation and also provides an improved seal, as will be described hereinafter.

[0020] The construction thus far described is generally as seen in W002/043810. Other constructions of flap are well known in the art, and examples can be seen in EP-A-300992, which shows a square or rectangular flap, and EP-A-829689.

[0021] In operation, the motor is driven to rotate the flap 12 into the open position and hold it there, shown in dotted outline, against the force of the springs 18. In the event of a fire, the motor power is cut off, allowing the flap to rotate to the closed position under the force of the springs 18. The overlap of the perimeters of the flap portions 12b, 12c adjacent flange 12d with the flange 6, and particularly the overlap at the corners 11, 12f ensures a good seal. The regions 12e, where the flap 12 is cut away may allow a small mount of air or smoke to pass but this will be rapidly blocked by soot etc., in the event of a fire.

[0022] By means of the motor 24, the flap 12 can be held in an intermediate position, thus serving to control the flow of air through the duct during normal operation. Typically, the degree of opening of the flap 12 would be set on installation of the system to balance air flow through the system, and then left.

[0023] In the duct 2 the normal air flow is in the flow direction of arrow A. Thus the fixings, such as the rivets holding rim 4 are closed or sealed. This reduces the risk of smoke escaping through the fixings once the flap 12 is closed. It will be appreciated the arrangement could be reversed, with air flowing in the direction of arrow B.

[0024] Referring to Figure 3 this shows schematically a motor unit 25 comprising a socket 26 which is coupled to the shaft 28 of a motor 30, by gearing 32, housed in a housing 34. Such motors are supplied by Belimo Automation AG of Switzerland. Typically, socket 26 may have an internal bore 27 of diameter 10 or 12 mm.

[0025] As seen in Figure 4, the wall 36 of socket bore 27 is a sixteen sided convex-concave polygon, having 8 apices or corners 38. Thus socket bore 27 will receive a square section shaft in a number of orientations to allow for easy fitting of the motor unit over the shaft end and onto the duct wall. Bore 27 could be a simple con-

cave shape such as a square or hexagonal cross section, for example, or have more apices. The present invention is concerned with fitting a round cross section shaft, typically a circular cross section shaft, into socket 26 for rotation with the socket.

[0026] Shown in Figure 4 is a steel shaft 14 with a steel pin 40 which extends through a diametral bore 42 in the shaft 14 to form two protuberances or projections 44 extending from the shaft outer surface 14c so as to project between the adjacent walls of an apex 38. The ends 40a of the pin 40 are chamfered to sit more comfortably in the apices 38. It can be seen that pin 40 allows for some play in the connection between the shaft 14 and socket 26, which will serve to accommodate a small amount of misalignment between the shaft 14 and socket 26. Pin 40 could be floating in bore 42 or fixed in position, for example by spot welding.

[0027] Referring to Figure 5, this shows in perspective view a shaft 14 with a pin 46 which extends through a diametral bore 42 in the shaft 14. Pin 46 is bent where it exits the shaft 14 to form protuberances in the form of two legs 46a, 46b which lay generally parallel to the shaft 14. The pin 46 is free to rotate in the bore 42, as signified by the dotted outline.

[0028] As seen in Figure 6, the legs 46 engage in the apices 38 of the socket bore 27.

[0029] Typically shaft 14 may be 9mm diameter, and pin 46 may be 3mm diameter, but the chosen dimension will depend on the required strength for shaft 14, and the size of the socket

[0030] Various modifications will be apparent to those in the art. Although the invention has been described with particular reference to circular cross-section ducts, it can be used with rectangular or other cross-section ducts.

Claims

1. A fire damper in a ventilation duct, the damper comprising a flap which is pivotably mounted in the duct for movement from an open position, allowing air flow along the duct, to a closed position to inhibit air flow or the passage of flame along the duct, the flap is pivotally mounted on a round cross section axle which extends through the duct wall and a motor is mounted on the end of the axle for rotation of the flap, the motor having a polygonal socket for receiving the shaft end, wherein a protuberance is provided on the shaft surface for engagement with the socket wall to cause the axle to rotate with the socket.
2. A fire damper as claimed in claim 1, wherein the protuberance extends into an apex formed between two sides of the socket wall.
3. A fire damper as claimed in claim 1 or 2, wherein

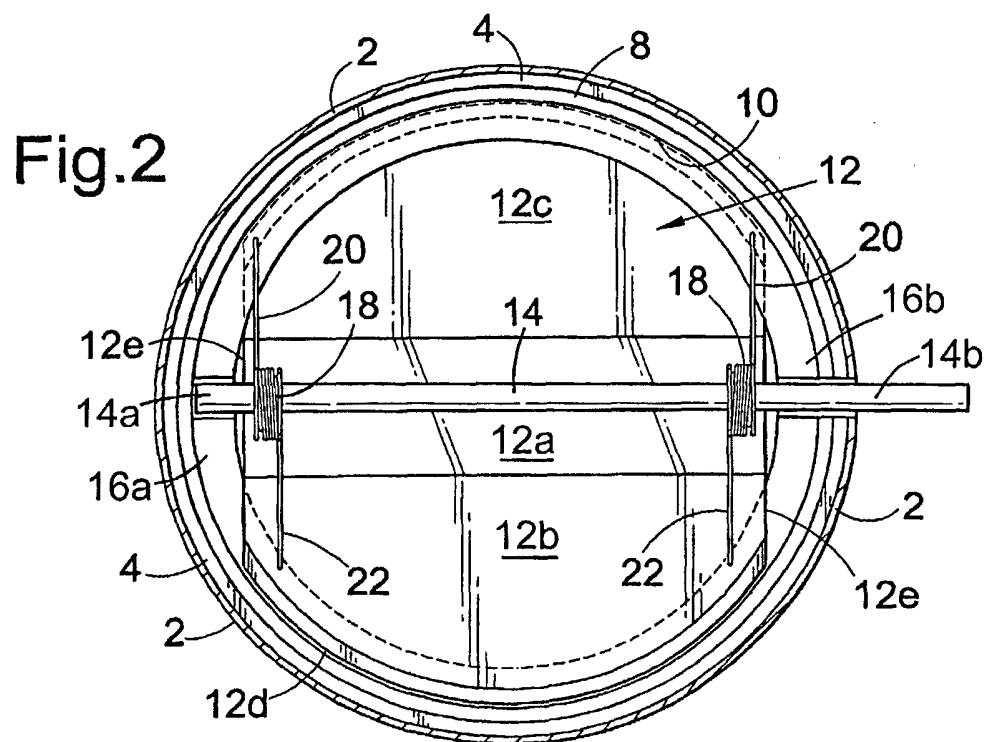
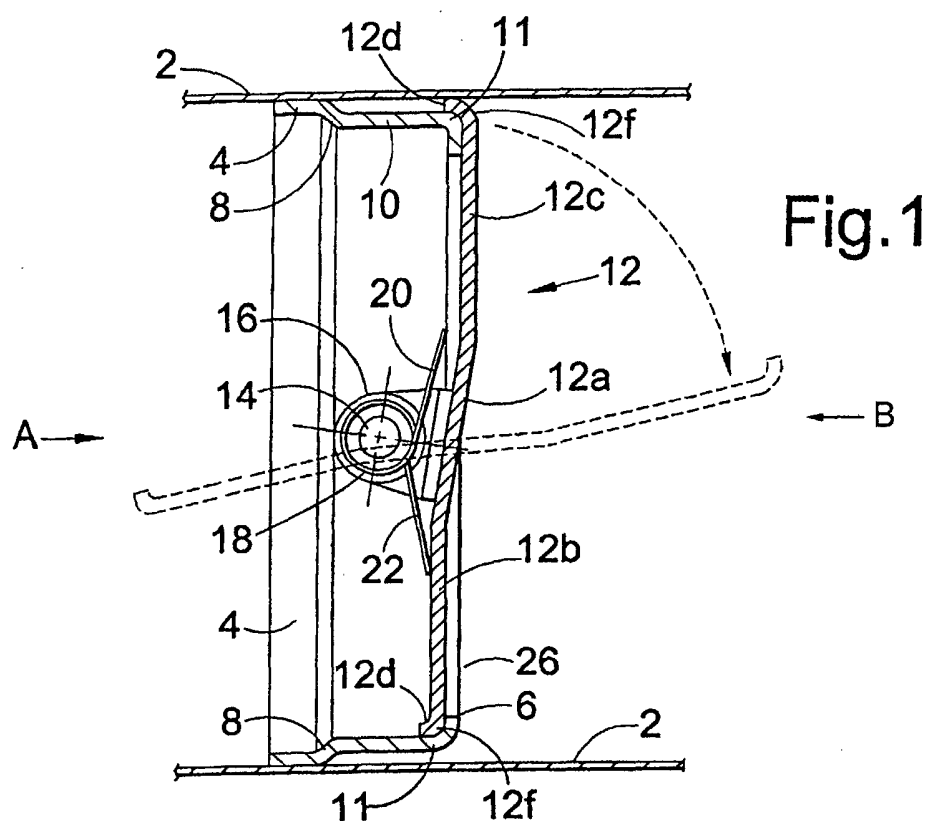
two protuberances are provided, substantially diametrically opposite one another on the shaft.

4. A fire damper as claimed in any one of claims 1 to 4, wherein the protuberance is formed by a pin which is positioned in a bore in the shaft. 5
5. A fire damper as claimed in claim 4, wherein the end of the pin distal of the shaft is tapered. 10
6. A fire damper as claimed in claim 3, wherein the pin extends through the shaft, forming protuberances on opposite sides of the shaft.
7. A fire damper as claimed in claim 6, wherein the pin is angled where it leaves the shaft, and directed lengthways of the shaft. 15
8. A fire damper as claimed in claim 7, wherein the pin is pivotable relative to the shaft. 20
9. A flap for a fire damper according to any one of claims 1 to 8, having an axle and a protuberance on the axle. 25
10. A fire damper comprising a flap mounted on a rotatable axle, and a socket receiving an end of the axle, the socket having a polygonal inner surface, wherein a protuberance is provided on the shaft outer surface, the protuberance engaging with the socket wall to transfer rotational movement between the socket and the axle. 30
11. A fire damper as claimed in claim 10, wherein the protuberance extends in the axial direction of the axle. 35
12. A fire damper as claimed in claim 11, wherein the protuberance is pivotable relative to the shaft to extend at an angle to the axial direction. 40

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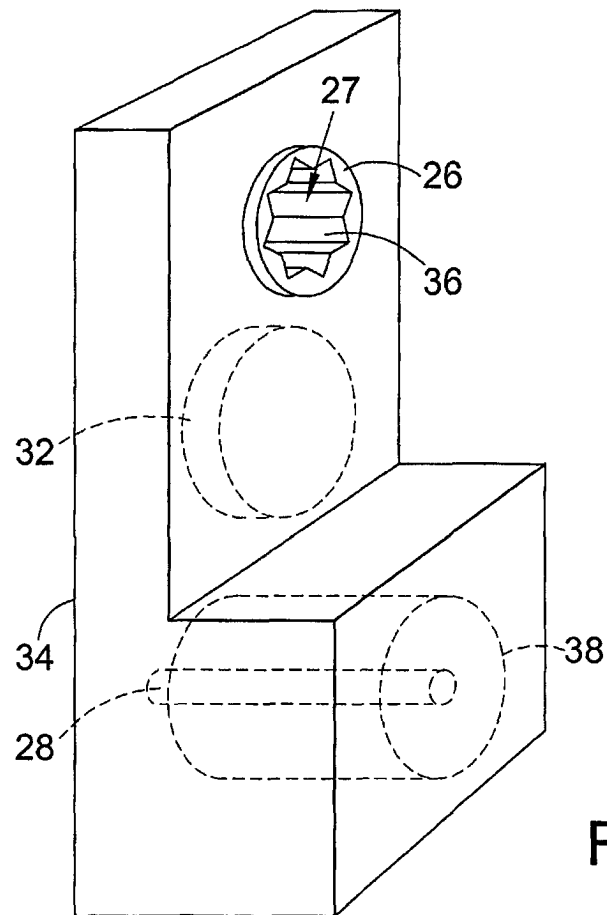


Fig.3

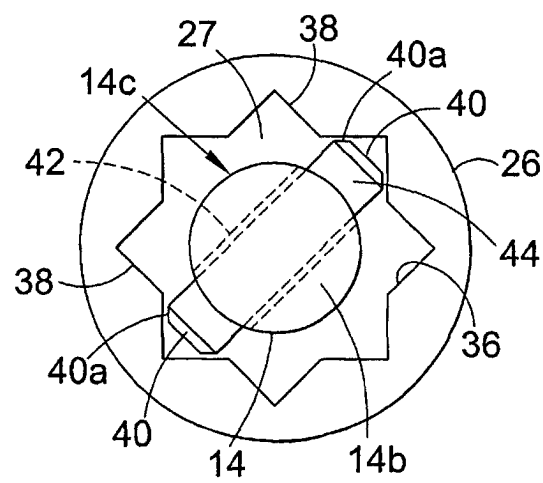


Fig.4

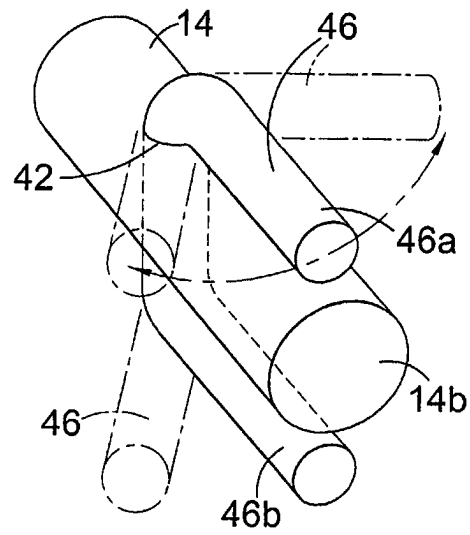


Fig.5

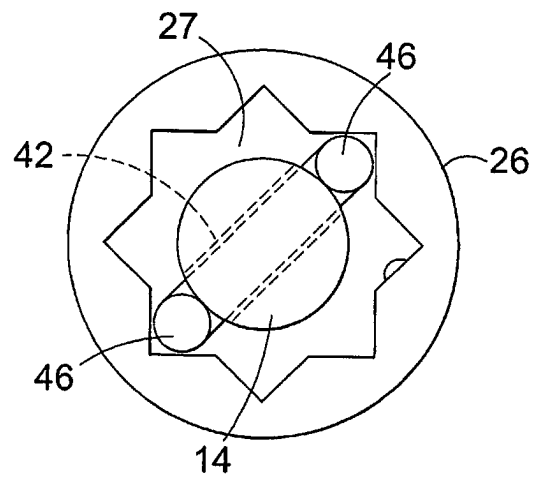


Fig.6



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 04 25 1469

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
Y	US 2 869 907 A (JOHN DELISO) 20 January 1959 (1959-01-20) * column 1, line 62 - column 2, line 62; figures 7,8 *	1-3,9-11	F24F13/14
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Y	US 6 198 243 B1 (KNUTZEN DOUGLAS G ET AL) 6 March 2001 (2001-03-06) * abstract; figure 1 *	1-3,9-11	
Y	US 4 193 541 A (SCHEIDWEILER A LEE) 18 March 1980 (1980-03-18) * column 3, line 53 - line 58; figure 1 *	1-3,9-11	
Y	US 6 431 203 B1 (ZHU HEXIANG ET AL) 13 August 2002 (2002-08-13) * column 5, line 46 - line 48; figure 2 *	1-3	
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The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 27 May 2004	Examiner Valenza, D
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 04 25 1469

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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27-05-2004

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