Feb. 11, 1969 K. KOSSOWSKI ET AL 3,426,507

ELECTRICAL PRECIPITATOR

Filed Dec. 23, 1964 Sheet 1 of 2

Fig. 1

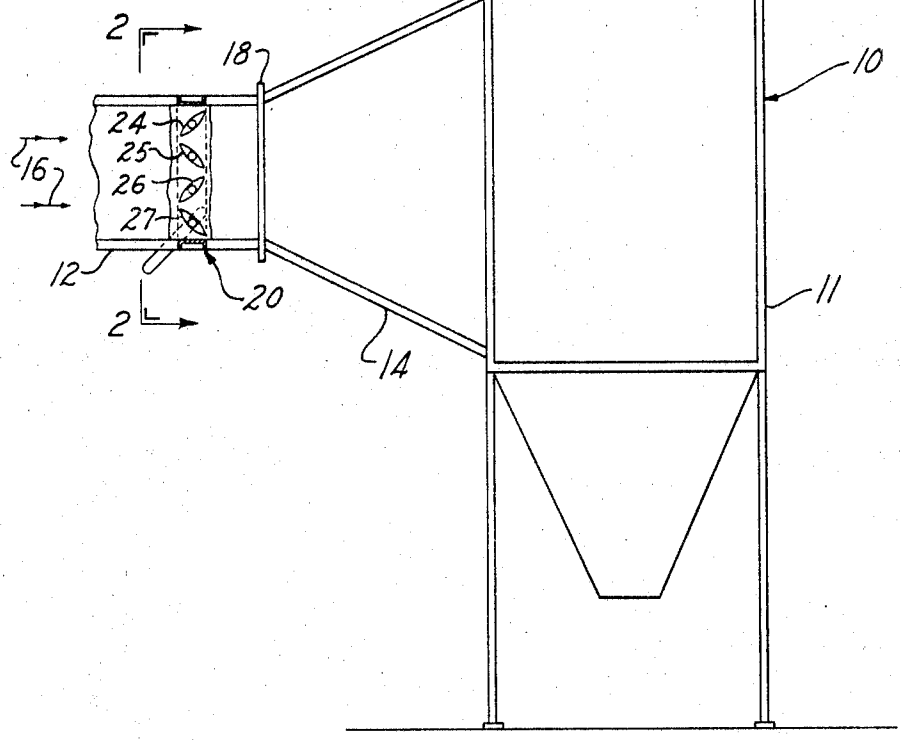
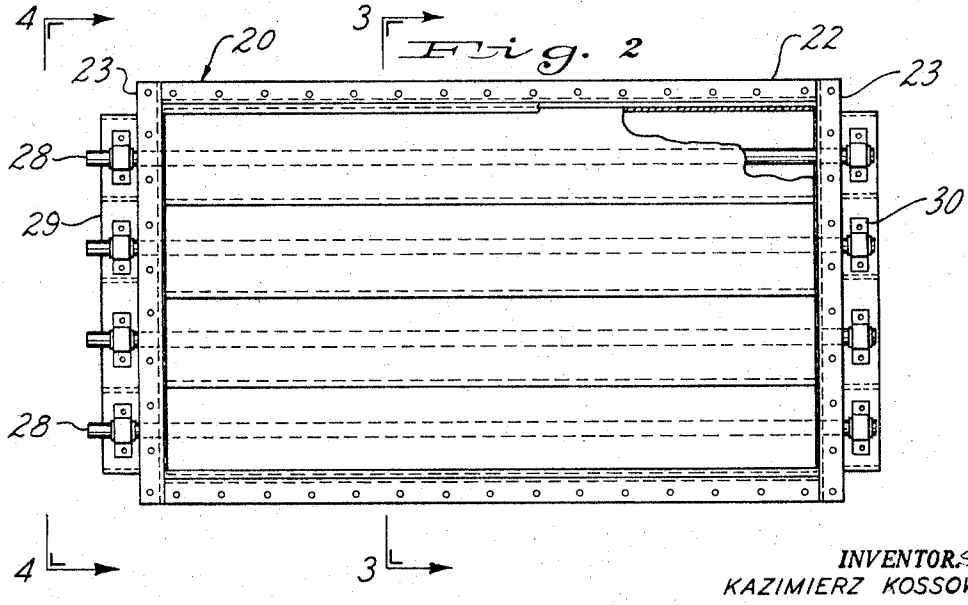


Fig. 2



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ELECTRICAL PRECIPITATOR

Filed Dec. 23, 1964 Sheet 2 of 2

Fig. 4

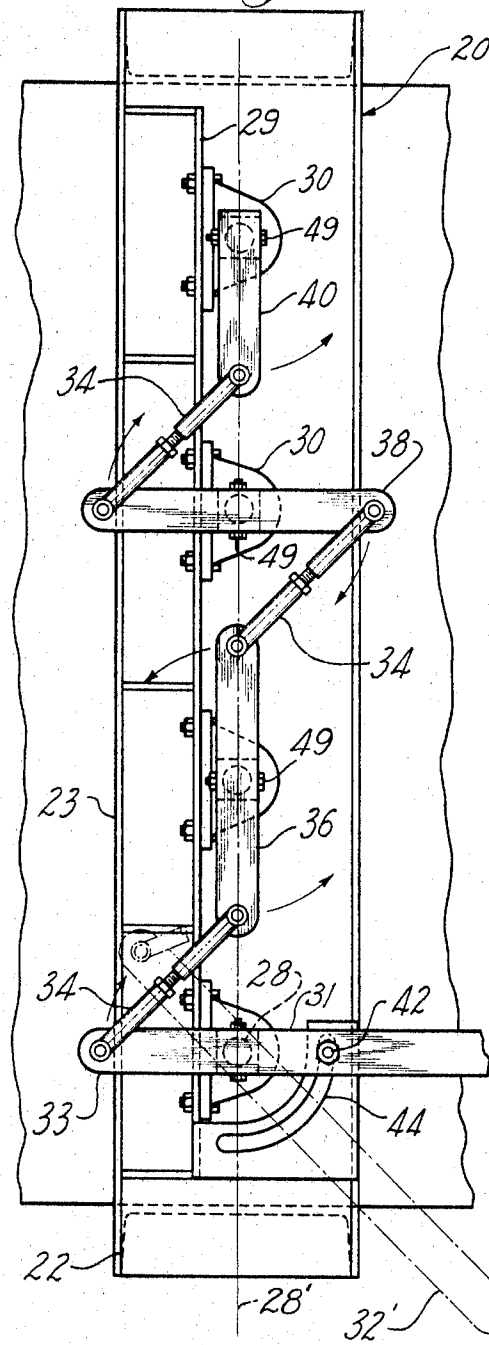
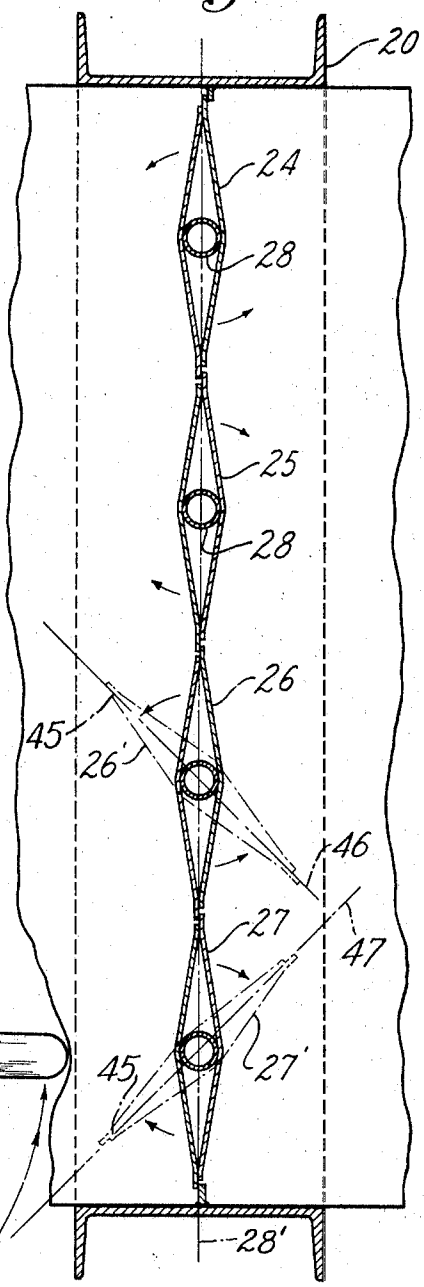


Fig. 3



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ELECTRICAL PRECIPITATOR

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Int. Cl. B03c 3/00

ABSTRACT OF THE DISCLOSURE

A louver damper for an electrical precipitator incorporating interchangeable links and levers cooperable to open and close the louvers in counter rotating sets to avoid turning vane effect in the partially open condition.

In the field of gas cleaning operations it is well known to apply fluid flow control devices to the dusty gas entering a precipitator or to the clean gas leaving the precipitator that under certain conditions a device having a plurality of elongated flat members or slats rotatable about their longitudinal axes and generally known as a louver damper is the most favorable type of adjustable fluid control device. It is further recognized in the field of gas cleaning operations that pairs of these slats must rotate in opposite directions to prevent the slats acting as turning vanes with resultant interference in gas distribution.

In devices of the prior art the requirement for opposite rotation of the adjacent louver slats has been satisfied by a variety of lever and link arrangements which have served the purposes but have not been entirely satisfactory under all conditions of operation for the following reasons:

A large number of individual moving parts was required;

There was no means of adjustment between the individual blades;

There was a multiplicity of different lengths of levers and links resulting in high fabrication costs;

There was a requirement for an operating lever mounted separately from the louver shafts requiring additional bearings and shaft.

The louver damper linkage of the present invention avoids these disadvantages in the following manner:

By providing means of adjustment between individual blades;

By providing opposite rotation of the individual louver slats with a minimum number of moving parts;

By the use of a repetitive design of levers and links so that fabrication cost is held to a minimum;

By mounting the operating lever directly on one louver shaft, thus eliminating additional bearings and shaft as required in prior art devices.

It is therefore an object of this invention to provide a new and improved louver damper linkage.

It is a further object of this invention to provide a new and improved louver damper linkage for a plurality of louver slats having an adjustable link between adjacent slats.

It is another object of this invention to provide a new and improved damper linkage wherein a minimum number of different parts is necessary to provide adjustable counter rotation of adjacent louver slats.

It is a specific object of this invention to provide a new and improved louver damper linkage having a plurality of louver slats mounted on parallel rotatable shafts with an operating handle and lever mounted on the shaft of one of the end slats and an operating lever mounted on the end of each remaining slat shafts with an adjustable

link connected between the ends of adjacent slat shafts to connect each of the operating levers to the next lever more remote from the operating handle throughout the extent of the plurality of louver slats.

These and other objects and advantages of this invention will become more readily apparent upon consideration of the following description and drawings in which:

FIG. 1 is a side elevational view of an electrical precipitator having a portion broken away to show a louver damper constructed according to the principles of this invention;

FIG. 2 is a partially sectional view taken substantially on line 2—2 of FIG. 1;

FIG. 3 is a sectional view taken substantially on line 3—3 of FIG. 2;

FIG. 4 is a side elevational view taken substantially on line 4—4 of FIG. 2.

As shown in FIG. 1 an electrical precipitator, of a type well known in the art, generally indicated at **10** comprises a closed housing **11** and an inlet duct **12** of generally rectangular cross section communicating with the housing **11** through a hollow generally frusto-pyramidal transition duct **14**. Ducts **12** and **14** provide for a flow of dusty gas from a source of such dusty gases (not shown) entering the duct **12** from the left, as shown by the arrows **16**, to spread out from the cross-section of the duct **12** through the transition duct **14** and enter a major portion of the side of the precipitator **10** as is familiar to those well versed in the precipitator art. The inlet duct **12** is rigidly secured to the transition duct **14** by way of mating flanges **18** held together by bolts, rivets or clamps in any well known manner.

At a point in the duct **12** near the junction of the duct **12** and the transition duct **14** there is rigidly secured a fluid flow control device constructed according to the principles of this invention and hereinafter referred to as the louver damper **20**, positioned across the inlet duct **12** to control fluid flow therethrough. The louver damper **20** comprises a rectangular frame **22** made up of four pieces of outwardly facing channel iron rigidly secured together to form a hollow frame having an internal rectangular cross-section of the same dimensions as the inside of the inlet duct **12**. Pivotably mounted within the frame **22** and extending longitudinally thereacross is a plurality of elongated thin louver vanes or slats **24**, **25**, **26** and **27** numbered from the top down as shown in FIGS. 1 and 3 with the lowermost slat being numbered **27**. Each slat, as best seen in FIG. 3, comprises two elongated generally rectangular flat pieces of thin metal having the respective longitudinal edge portions **45** secured together by welding and their longitudinal center portions separated, held apart by and rigidly secured to, an elongated hollow shaft **28** extending horizontally across the frame **22** and through and beyond the end pieces **23** with the edges **45** and the centerline of the shaft **28** in a common plane as at **46** and **47** (see FIG. 3) hereinafter designated the plane of the respective slat (e.g. **26'** and **27'**). The shafts **28** are rotatably secured in bearing members **30** rigidly secured to an outwardly extending plate **29** mounted on the respective end pieces **23** so that the slats **24–27** are free to rotate about the center lines of the shafts **28**. The slats **24–27** are of a width to completely cover the area within the frame **22** with suitable overlapping portions as best seen in FIG. 3 with the planes of the respective slats **24**, **25**, **26** and **27** forming a single plane **28'** containing the longitudinal centerlines of all the shafts **28** so that in the closed position shown in FIG. 3 the slats completely shut off the inlet duct **12**. All of the shafts **28** have an extended end portion extending beyond the outer edge of the plate **29** on one end (shown to the far left in FIG. 2) to allow the mounting thereon of a

lever element as seen in FIG. 4 and as hereinafter described. The lever element of the shaft 28 of the slat 27 is an elongated member 31 rigidly secured at an intermediate portion thereof in keyed relationship with shaft 28 of the slat 27 as by a bolt 49 extending through the shaft 28 and the member 31 concurrently with the member 31 substantially normal to the plane 47 of the slat 27. An elongated portion of the member 31 extending normal to the shaft 28 to the right as viewed in FIG. 4 forms the handle portion 32 of the member 31 while a shorter portion extending normal to the shaft 28 in the opposite direction forms a lever portion 33 of the member 31. Pivotably connected to the lever portion 33 near the end thereof is an adjustable double clevis link 34 having one clevis pivotably engaged with the end portion of the lever element 33 and the other clevis connected to an end portion of a double ended lever 36 rigidly mounted at its center to the shaft 28 of the slat 26 and having its longitudinal axis in the plane of the slat 26 and substantially parallel to the end of the slat 26. In like manner a second double ended adjustable link 34 is pivotably secured between the end portion of the lever 36 more remote from the handle element 32 and an end portion of a lever 38 similar to the lever 36 but mounted at its center portion in keyed relationship to the shaft 28 of the slat 25 with the lever 38 extending normal to the plane of the slat 25. Similarly the other end of the link 38 is connected by another double clevis link 34 to the end of a single arm lever 40 having one end portion pivotably connected to the link 34 and the other end portion rigidly secured in keyed relationship to the shaft 28 of the slat 24 and extending generally parallel to the end of the slat 24 and having a central longitudinal axis in the plane of slat 24.

It is to be noted that the alternate slats 24 and 26 with their respective shafts 28 and levers 40 and 36 form a first set of louver elements each having a lever parallel to the respective slat end while the remaining slats 25 and 27 with their respective levers 38 and 33 form a second set of louver elements each having a lever normal to the plane of the respective slat to which it is connected by a shaft 28. In this respect the term "louver element" includes one slat, one shaft on which the slat is mounted and one lever keyed to the end of that particular shaft.

It is to be further noted that the adjustability of the links 34 is such as to provide a substantial variation in the lengths of the links 34.

Rotation of the handle 32 is limited to approximately 90° by a stop member 42 mounted in an intermediate portion of the handle 32 and operating in a curved slot 44 coaxial with the shaft 28 of the slat 27 and having a circumferential dimension of approximately 90°.

Operation of the device of this invention starts with the louver damper 20 in the closed position as shown in FIGS. 3 and 4 with the slats 24–27 extending completely across the interior of the frame 22 and the inlet duct 12 as seen in FIG. 3. In this position all fluid flow through the inlet duct 12 and consequently through the precipitator 10 is shut off. When it is desired that flow should occur the handle 32 is operated downwardly in a clockwise direction to achieve the desired amount of opening with a rotation of 60° achieving approximately 50% opening and a 90° rotation resulting in full opening. When the handle 32 reaches the position shown in dot and dash outline in FIG. 4 and identified as 32' the slats 26 and 27 are then in the position shown in dot and dash outline (FIG. 3) and identified as 26' and 27'. It will be noted that when the slat 26 rotates in a counterclockwise direction the slat 27' rotates in a clockwise direction and that this is true for all of the slats in the louver damper 20 of this invention so that each slat rotates in a direction opposite to the direction of either adjacent slat. The result of the above described opposite rotations is an even distribution of gas flow throughout the inlet duct 12 and the transition duct 14 since the slats 26 and 27 have opposite mutually-cancelling turning vane effect on the gas flow therethrough with a total of zero turning vane effect as long as an even number of vanes is used.

The utility of the adjustable links 34 is readily apparent when it is considered that manufacturing errors can easily result in the lever 36, for instance, being at a slight angle to the transverse plane of the slat 26 or the handle 32 could be at some other angle than normal to the transverse plane of the slat 27 which errors of positioning can be overcome in the device of this invention by shortening or lengthening the links 34 as required. When the links 34 are properly adjusted as to length the slats 24–27 will fit together as shown in FIG. 3 to give good closure across the duct 12 and will open evenly as shown in dotted outline in FIG. 3 to give straight gas flow through the louver damper of this invention.

The advantages inherent in the louver damper of this invention reside in having: a means of adjustment between individual blades to compensate for manufacturing errors; a minimum number of moving parts to reduce wear; a simple repetitive design of levers, links and slats resulting in minimum fabrication cost; and in the mounting of the operating handle directly on a louver shaft, eliminating additional bearings and shaft necessary with a separately mounted handle.

Although the above described embodiment of this invention comprises four slats of a particular size and shape it is contemplated that other numbers of slats and other modes of fabrication of the slats as well as different designs of the adjustable links 34 will be used to accomplish the purposes of this invention.

What is claimed is:

1. In a louver damper for an electrical precipitator in which a plurality of louver slats are mounted on a plurality of parallel rotatable shafts, having longitudinal centerlines equally transversely spaced apart by a given distance, respectively, for rotation by said shafts from a first closed position to a second full open position the improvement comprising: straight double arm members of a length equal to said given distance centrally mounted on one ends of intermediate ones of said shafts, respectively; a single arm member of one-half said given length mounted on said one end of each of the non-intermediate ones of said plurality of shafts, alternate ones of said arm members being fixed on said shafts ends normal to the planes of the respective slats, the remaining ones of said arm members being fixed on the respective shaft members parallel to the planes of the respective slats; equal length elongated link members connecting adjacent ones of said arm members in series so that the oppositely disposed arms of said arm member of each of the intermediate ones of said shafts are connetced to oppositely disposed arms of said arm members of oppositely adjacent shafts, respectively, by one of said links; means for rotating one of said shafts whereby adjacent ones of said shafts are rotated in opposite directions by said links, respectively; and means for limiting said rotation to approximately ninety degrees of rotation in opposite directions from said first position to said second position and return.

2. In a louver damper the improvement as specified in claim 1 wherein said means for rotating is an oppositely extending elongated arm portion of one of said single arms having an end portion usable as a handle.

3. In a louver damper for an electrical precipitator in which a plurality of louver slats are mounted on a plurality of parallel rotatable shafts, having longitudinal centerlines equally transversely spaced apart by a given distance, respectively, for rotation by said shafts from a first closed position to a second full open position the improvement comprising: straight double arm members of a length equal to said given distance centrally mounted on one ends of intermediate ones of said shafts, respectively: a single arm member of one-half said given length mounted on said one end of each of the non-intermediate ones of said plurality of shafts alternate ones of said arm members being fixed on said shaft ends normal to the planes of the

respective slats, the remaining ones of said arm members being fixed on the respective shaft members parallel to the planes of the respective slats; elongated adjustable link members of substantially equal length connecting adjacent ones of said arm members in series so that one arm of the oppositely disposed arms of said arm member of a particular one of the intermediate ones of said shafts is connected to an arm of said arm member of an adjacent shaft and the remaining arm of said arm member of said particular shaft is connected to the oppositely disposed arm of the arm member of the shaft oppositely adjacent said particular shaft, respectively, by one of said links: means for rotating one of said shafts whereby adjacent ones of said shafts are rotated in opposite directions by said links and means for limiting said rotation to approximately ninety degrees of rotation in opposite directions from said first position to said second position and return.

4. In a louver damper the improvement as specified in claim 3 wherein each said adjustable link member comprises a pair of threaded clevis elements threadedly engaged with each other.

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U.S. Cl. X.R.

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