Nov. 2, 1971 W. STEUERNAGEL ET AL 3,616,608

DISCHARGE ELECTRODE FOR ELECTROSTATIC DUST COLLECTORS

Filed July 8, 1969 4 Sheets-Sheet 1

Fig. 1

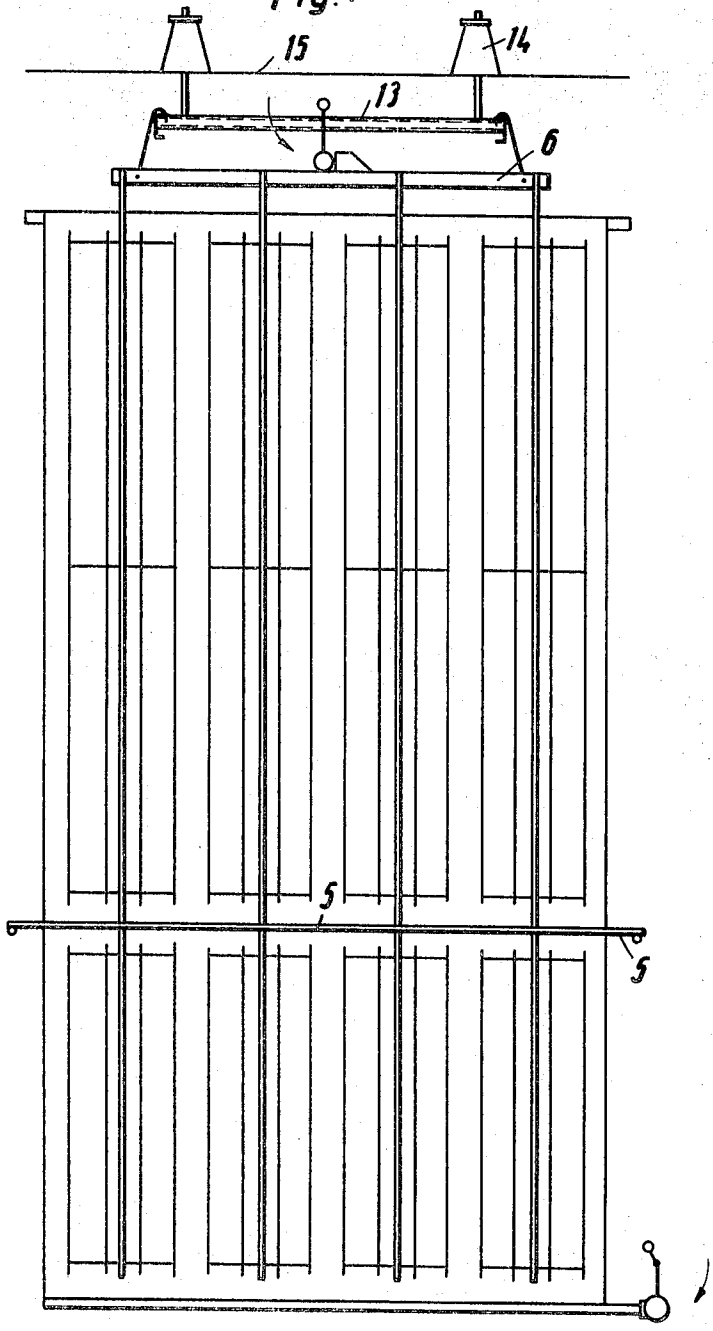
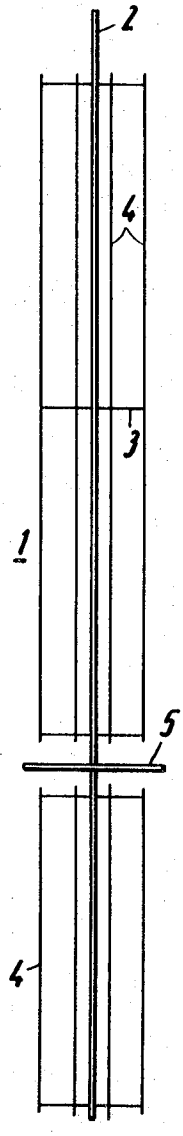


Fig. 2



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Fig. 3

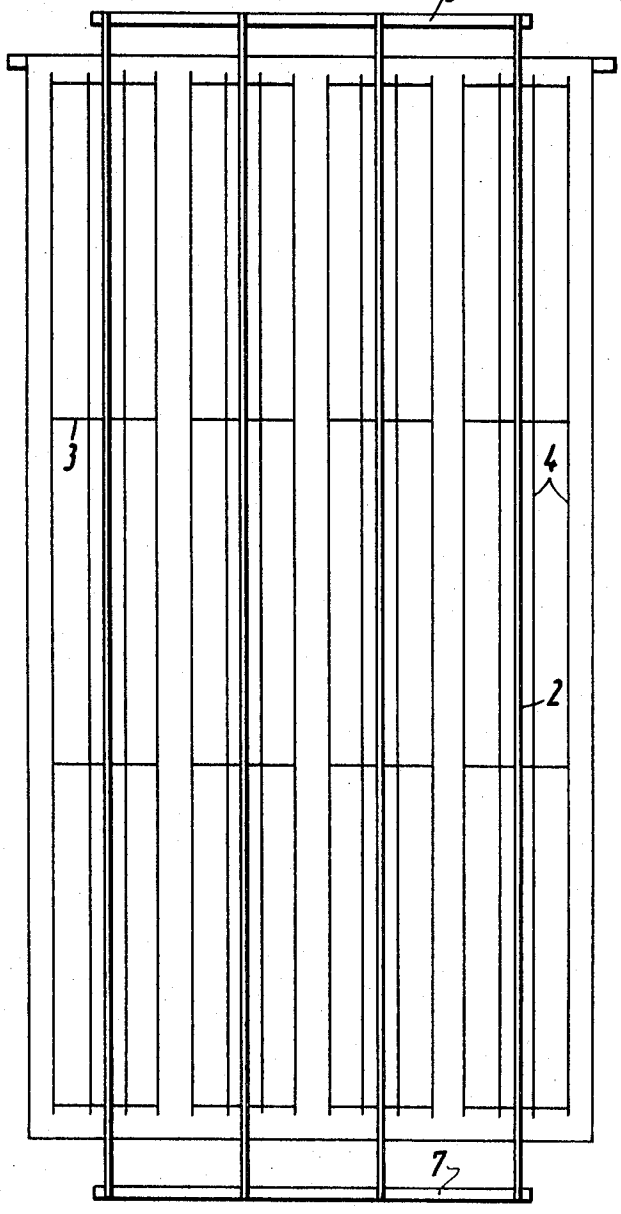
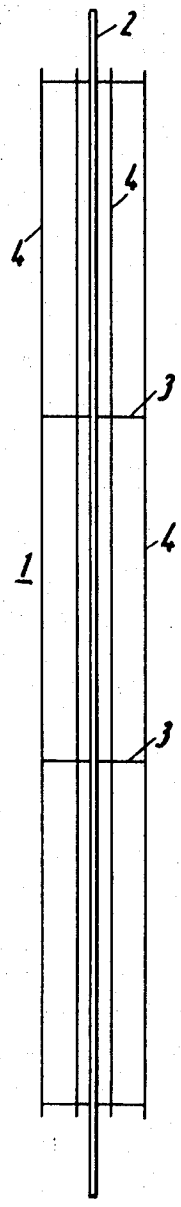


Fig. 4



DISCHARGE ELECTRODE FOR ELECTROSTATIC DUST COLLECTORS

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Fig. 5

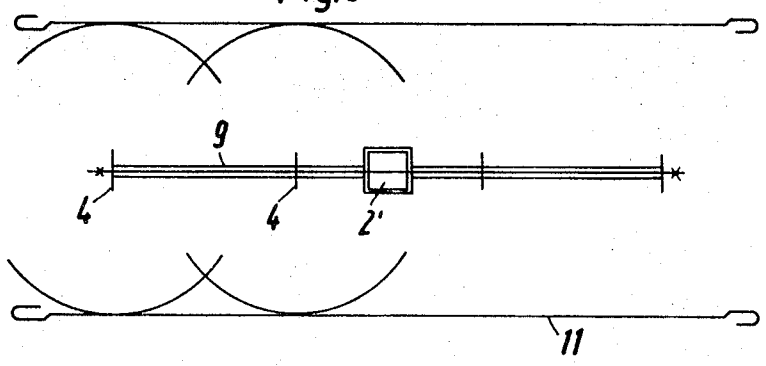


Fig. 6

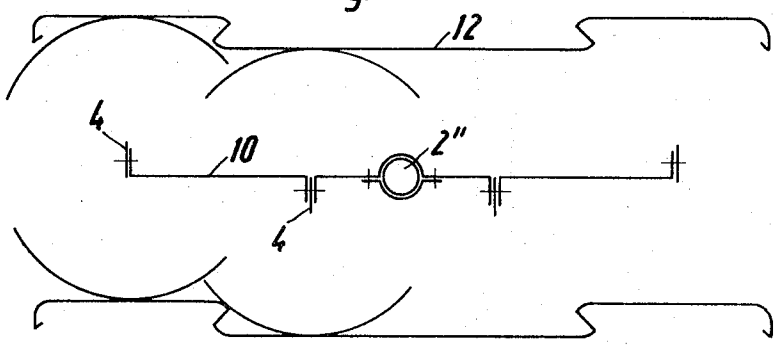


Fig. 7

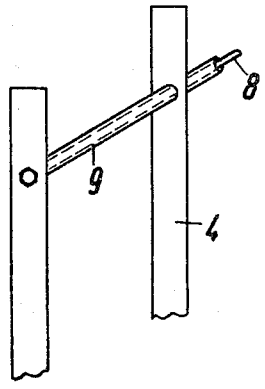
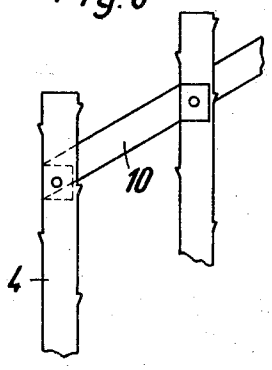


Fig. 8



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Fig. 9

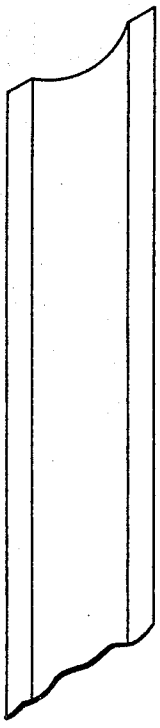


Fig. 10

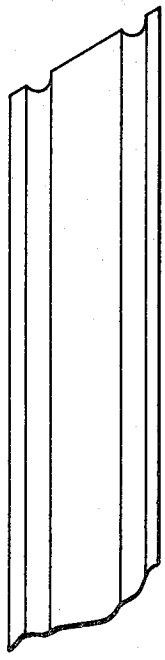


Fig. 11

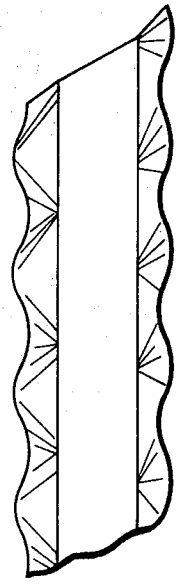


Fig. 12



United States Patent Office 3,616,608 Patented Nov. 2, 1971

3,616,608

DISCHARGE ELECTRODE FOR ELECTROSTATIC DUST COLLECTORS

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Claims priority, application Austria, July 15, 1968, 6,822/68
Int. Cl. B03c 3/41
U.S. Cl. 55—148 3 Claims

ABSTRACT OF THE DISCLOSURE

The discharge electrode for an electrostatic dust collector is prefabricated for shipment to the field construction site. It is composed of pairs of spaced electrode strips attached to opposite sides of a mast. Groups of the electrodes can be preassembled into an areal discharge electrode structure.

This invention relates to a novel discharge electrode for electrostatic dust collectors without using the usual unwieldy discharge frames heretofore used.

German registered design 1,600,421 discloses how discharge wires are constructed for instance by means of a frame structure consisting mostly of pipes. German registered design 1,811,440 reveals that such discharge frames can also be equipped with discharge strips, star wires and round wires. Such discharge strips have the advantage of a higher rigidity as compared to the discharge wires and it is also possible to provide the strips with discharge points by stamping out of edges and prickles. Discharge strips of this type are disclosed in German registered design 1,961,122, German registered design 1,799,730, and in German patent application 1,155,422. Though the pipe discharge frames have a comparatively high rigidity, practice proved that in electrostatic dust collectors with field erection heights of for instance 12 m., there can occur deformation and warping by which the electrical collecting fields are disturbed considerably. A warping of the pipe discharge frames results in unequal voltage distances which causes troublesome flashing and spoils the collecting efficiency significantly.

Therefore, it was tried to construct sturdy frames of flat iron or sections as disclosed in German Registered Design 1,878,831, which frames are assembled on the principle of constructional units in order to arrive at a rigid discharge electrode or discharge wall for electrostatic dust collectors with extremely great field erection heights. But also in this case experience proved that the rigidity over the height could only be attained if not too long gas ducts were concerned. This is, however, mostly the case of electrostatic dust collectors with a field height of 12 m. as in such dust collectors extremely large gas volume are cleaned. Despite the comparative plane rigidity of the frames, the problems described above appear also with this construction if field lengths of 10 to 12 m. have to be dealt with and a subdivision into several fields is not considered.

In the case of the employment of discharge strips, there is not the possibility of their support as disclosed for instance in German Pat. 1,039,037 in which the individual discharge wires are weighted at their lower ends thereby saving the discharge frame structure as is currently practiced in pipe type dust collectors. The increased discharge occurring in the strips would lead to a swaying

of the individual walls, thus causing precarious conditions with regard to the discharge distance and again troublesome flashing can take place. Besides it can be that in electrostatic dust collectors of the current large type it is no longer sensible to employ weights for keeping the individual discharge electrodes taut, be it only for pure constructional considerations and for reasons of stability.

Therefore, it has been proposed to avoid the discharge frames and to construct discharge electrodes consisting of tubular supports which have several rows of side arms provided with discharge points. But in this way only two discharge wires or discharge strips being side by side could be substituted. If longer side arms are employed in order to have several discharge points on each of them, the structure becomes unstable due to its areal extension and because it is carried centrally by the tubular support. An arrangement of this kind is disclosed in German patent application 1,264,409. From the above discussion, it follows that up to now no success lay in constructing a discharge electrode for an electrostatic dust collector in which the frame could be avoided and in which nevertheless several discharge elements as for instance discharge wires and discharge strips could be arranged side by side without necessitating too great a material input.

The object of this invention is to produce a discharge electrode overcoming the aforesaid disadvantages and to keep the material consumption extremely low.

This invention is for a discharge electrode for electrostatic dust collectors with a centrally arranged supporting mast provided with side arms for holding discharge elements for instance for discharge strips, in which at least two discharge strips are attached to the arms on each side of the supporting mast parallel to the gas flow direction by means of distance pieces, and in which the discharge strips have a width of at least the width of the supporting mast normal to the gas flow direction.

The supporting mast in this invention can be hollow and can have a rectangular or round cross-section.

According to a further feature of this invention, the side arms are made of rods and the distance pieces are pipes.

It is within the scope of this invention that the discharge strips are arranged off-center with regard to the center line of the gas duct, and that the ends of the arms are bent alternately in the same sense of rotation.

According to a further feature of this invention, a plurality of supporting masts with discharge strips are hung on a supporting frame in order to form an areal discharge electrode structure.

The discharge electrodes of an areal discharge structure in this invention are guided at their lower end by a guiding frame.

In this invention, the discharge electrodes of an areal discharge structure are spaced by a cross-ties consisting of individual pipes attached firmly to the supporting masts and a rod stuck through the pipes over the whole width of the structure.

It is within the scope of this invention that the discharge strips are provided with stiffening ribs.

The edges of the discharge strips in this invention can also be undulated.

The discharge structure or the discharge strips in this invention satisfy many requirements and have a wide range of variations. A further advantage as compared with the discharge electrodes heretofore used consists in the ability to manufacture and to assemble the novel electrodes of this invention in the workshop thereby simplifying the erection work on the construction site. The shipping can be done in packing units ready to be erected at the site. The avoidance of the bulky discharge frames,

which in the collector dimensions of today had to be shipped subdivided and assembled only at the site, by using frames ready to be erected is an additional great advantage. For instance, if in operation a discharge strip, which is more robust than for instance a discharge wire, would nevertheless break there is the possibility to raise or lower the supporting mast to repair it, or to take it out of service without being forced to open the collector roof of a present-day dust collector and to dismantle the entire supporting frame of a gas duct. A discharge structure consisting of individual discharge masts, as the subdivision of the structure according to this invention shall be termed, allows the widening of the ends of the collecting electrodes towards the middle of the gas duct and furthermore a spacing of the discharge electrodes transverse to the gas flow direction as the discharge electrodes are not interconnected in the gas flow direction, that is no pipes are running in the gas flow direction as is for instance the case at the pipe frame discharge structures of today with lateral supports, spacing and rapping. The advantageous possibility of arranging the individual discharge strips off-center with regard to the center line of the gas duct is hereafter described.

The means by which the objects of this invention are obtained are described more fully with reference to the accompanying schematic drawings, in which:

FIG. 1 is a front view of an areal discharge electrode structure;

FIG. 2 is a front view of a single discharge electrode as used in FIG. 1;

FIG. 3 is a front view of a modified electrode structure;

FIG. 4 is a front view of a single discharge electrode as used in FIG. 3;

FIG. 5 is a plan view of the electrode structure mounted between dust collecting electrodes;

FIG. 6 is a modification of FIG. 5;

FIG. 7 is a perspective view of two spaced electrode strips;

FIG. 8 is a modification of FIG. 7;

FIGS. 9, 10 and 11, respectively, are perspective views of differently shaped electrode strips; and

FIG. 12 is a cross-sectional view through FIG. 11.

As shown in FIGS. 1 and 2, the single discharge electrode **1** is composed of a supporting mast **2**, side arms **3**, and discharge strips **4**. Between the lower third of the discharge strips and the upper two-thirds is left a space in order to place there the spacing cross-tie **5** as shown in FIG. 2. The discharge electrodes **1** can be hung on an upper supporting structure **6**, and the spacing cross-tie **5** of FIG. 1 as shown for instance in FIG. 3 can be substituted by a lower guiding frame **7**. As FIG. 1 shows, rapping mostly takes place on the upper supporting structure **6**. But it is also possible to rap the lower guiding frame **7**. The width of the discharge electrode **1** corresponds to the width of a collecting electrode strip **10** or **11** which is in practice about 640 mm. The height of the discharge electrode corresponds to the field erected height of the active electrode collecting surface. Thus about four to nine individual discharge elements like FIG. 1 or 3 belong to one gas duct depending upon the number of collecting electrode strips **6** or **11**. Mostly they are supported and rapped on their top **6** and spaced by means of a cross-tie **5** as already explained. The cross-tie can be hollow, and for spacing purposes a rod **8** is shoved through the row of discharge electrodes and their cross-ties. As shown in FIGS. 5 and 6, the supporting mast **2'** is of rectangular cross-section, or in FIG. 6 made of a tube **2''** with discharge strips **4** running parallel thereto. The spacing of the discharge strips in the gas flow direction is also determined by the width of the gas ducts and has to be chosen so that only a minimum of screening between the individual discharge strips takes place. The discharge strips **4** are connected to the center supporting mast by means of suitable side arms **3**. The distance of the side arms **3** from each other over the field height is chosen as large as practicable in order to save weight and amounts in practice to several meters. FIG. 5 shows straight dust collecting electrodes **11** in which the center lines of the discharge strips lie on the center line of the gas duct and on the axis of the supporting mast **2'**. In order to avoid troublesome discharge effects at the supporting mast **2**, the width of the individual discharge strips **4** is made at least equal to the width of the cross-section of the supporting mast normal to the collecting electrode. In FIG. 5, the supporting mast **2'** has holes through which rods **8** threaded at their ends extend. Discharge strips **4** also have holes, and for spacing purposes, pipe distance pieces **9** are inserted between them and tightened by nuts on the rods. For the sake of reliableness, lock washers or other safety means for the nuts are applied. Compared to FIG. 5, FIG. 6 shows an arrangement of a discharge mast **2''** in shaped collecting electrodes in which the discharge strips **4** are placed off-center with regard to the center line of the gas duct. The effective discharge distance from the edges of the discharge strips to the opposite dust collecting electrode surface is equal, this means the off-center of the discharge strips is equal to the recessed depth of the collecting electrode. The attachment of the discharge strips to the supporting mast **2''**, which in this case is a tube, takes place by means of flat irons **10** bent 90° at their ends and by screws, rivets or by spot welding. In FIG. 6, the supporting mast has not been provided with holes, but a clamp joint has been chosen for example. FIGS. 7 and 8 are perspective views of details of the attachment of the discharge strips. Due to the required electrical properties, the discharge strips **4** are thin smooth steel bands of a thickness of less than one millimeter with or without discharge points. But the construction of the discharge electrode allows also the application of any other kind of discharge elements as, for instance, round wires, barbed wires and the like instead of the strips between the distance pieces or other supporting devices. In FIG. 6, the supporting flat irons **10** for the discharge strips **4** are at the same time spacing devices. Straight collecting electrode sheets **11** are shown in FIG. 5, and shaped collecting electrode sheets **12** in FIG. 6. In order to fasten the thin strips of a thickness of for instance 0.7 mm. to the side arms **3** placed wide apart from each other and in order to avoid deviations from the vertical in the gas flow direction the strips are stiffened in this direction by suitable shaping. An electrical shielding of the discharge edges by the shaping must be avoided, and this means the shape of the strips can be chosen as shown for instance in FIGS. 9, 10 and 11. FIG. 9 shows a slight arch-like curvature, FIG. 10 two stiffening ribs, and FIG. 11 indicates a sitffening of the thin strips by giving the two edges of the strip an undulated shape in the form of sinus waves. A cross-section of the discharge strip of FIG. 11 is shown in FIG. 12 for more clarity.

As already explained, the discharge electrodes **1** of one gas duct are combined at their upper ends and carried by a supporting structure **6** and cleaned by rapping. The supporting structure **6** is pendulum-like suspended from the frame **13**, FIG. 1, which hangs on the roof of the casing **15** by means of insulators **14**. A connecting element possibly without lateral clearance as, for instance, a clamping sleeve serves to transmit effectively the rapping blows from the rapper bar to the individual discharge electrodes **1**. A filling piece can be welded in to reinforce the cross-section of the supporting mast. As with a firm clamping, a very good transmission of the rapping energy can be achieved, in this supporting method, the rapping structure is firmly connected with the supporting mast by two screws.

The disclosed arrangement of the discharge electrodes permits the use of simple supporting masts **2** with laterally arranged discharge strips **4** which are rigid and easy to install, in place of heavy discharge frames which become the more instable the more the height and the length of

the electrical field increase. These discharge strips can have arch-like curvatures FIG. 9, ribs FIG. 10 or undulations FIG. 11 in order to increase their stiffness and which, due to their arrangement normal to the gas flow direction, cannot deviate towards the collecting electrodes, thus decreasing the electrode distance and the collection efficiency.

Such discharge masts **2** are assembled with the discharge strips **4** already in the workshop thereby assuring a quick and time saving erection on the field site. The irksome stretching and straightening of the discharge wires of the discharge frame construction is avoided. Furthermore, the discharge masts can easily be exchanged without the necessity of opening the collector roof for this purpose.

Having now described the means by which the objects of this invention are obtained,

We claim:

1. A discharge electrode for an electrostatic dust collector comprising at least one vertical hollow supporting mast, flat iron side arms having their ends bent 90° and being attached to said mast and extending on opposite sides at right angles thereto; at least two discharge strips on each side of said mast and extending parallel thereto and being attached to said arms, said discharge strips having a width at least equal to the width of said mast normal to the length, supporting frame means, and said mast being hung from said frame means for forming an areal discharge electrode structure, and guiding frame means joined to the lower portion of said areal discharge electrode structure.

2. An electrode as in claim **1**, said discharge strips being positioned off-center with respect to said arms.

3. An electrode as in claim **1**, further comprising undulated edges on each discharge strip (FIG. 11).

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DENNIS E. TALBERT, JR., Primary Examiner

U.S. Cl. X.R.

55—150, 151, 154