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GAS CLEANING APPARATUS

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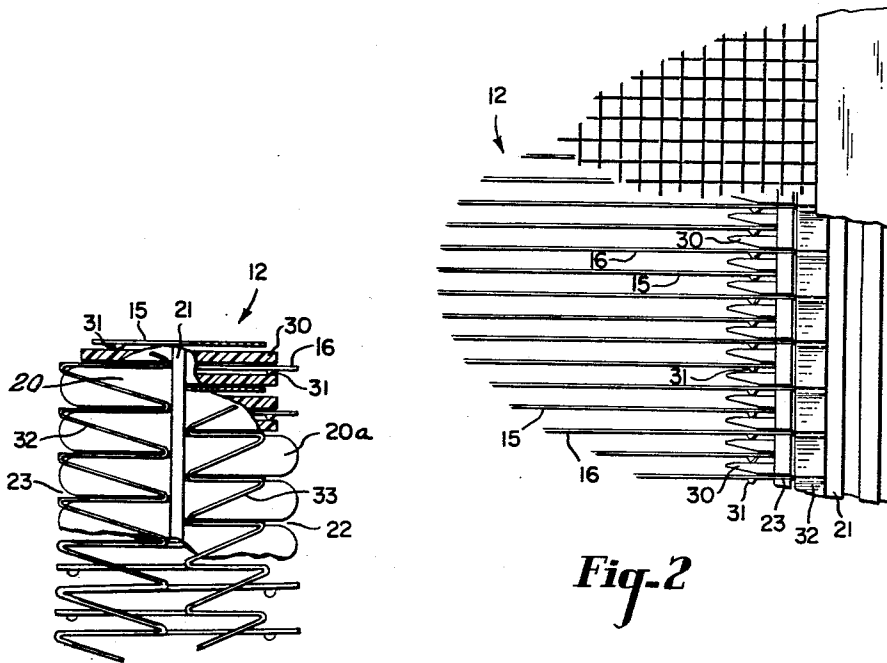
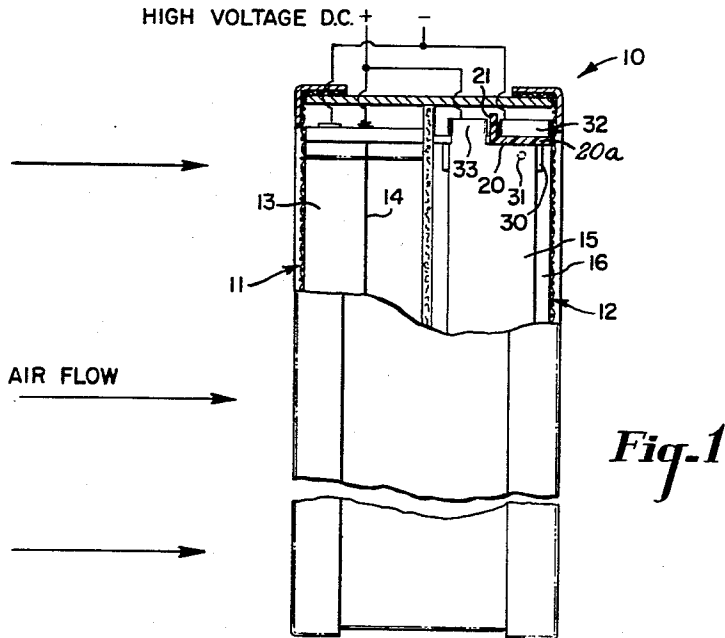


Fig. 3

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GAS CLEANING APPARATUS

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5 Claims. (Cl. 55-156)

The present application is concerned with an improvement in electrostatic gas cleaning apparatus; in particular, the improvement is in the design of the collecting section which is made up of two sets of parallel spaced plates. Each set of plates is electrically interconnected by a portion common to each plate of one set so that electrical connection is maintained between the individual plates.

In electrostatic air cleaners, the use of a high voltage presents numerous problems. With the high potential stresses are presented which present numerous problems. Where plates of an electrostatic air cleaner are connected by soldering wires between the plates or other types of jumpers mechanically connected to the plates, the chance of electrical disconnection is quite great. Once an electrical connection is broken, not only does a portion of the cell become inoperative, but electrical arcing produces unwanted ozone and undesirable noisy conditions. Obviously, if a gas cleaning unit is constructed with the utmost care, the likelihood of such mechanical failures in the electrical connections and the resulting arcing conditions is greatly reduced; however, in mass production where the ultimate cost of the unit greatly depends upon the time spent in labor, any improvement reducing such defects can be significant. In the present unit, the plate section is made of one part and a common portion at each end is left when the plates are made to provide the electrical connection. When the plates are assembled, the power supply is connected to one plate and immediately all the plates are electrically connected in a manner to insure that no subsequent electrical failure is likely.

An object of the present invention is to provide an improvement in electrostatic gas cleaning apparatus.

Another object of the present invention is to provide an improved electrical connection between sets of plates of an electrostatic gas cleaning apparatus.

Another object of the present invention is to provide a common portion which is maintained during the stamping or cutting of a set of plates of an electrostatic air cleaner so the plates will be interconnected by a rigid integral portion.

These and other objects of the present invention will become apparent upon a study of the specification and drawing of which:

FIGURE 1 is a side cutaway view of a typical electrostatic gas cleaning apparatus showing the ionization section and the collection section.

FIGURE 2 is an enlarged fragmentary view of the apparatus as seen from the right of FIGURE 1, FIGURE 2 being rotated 90° in a clockwise direction.

FIGURE 3 is a cutaway view of the collecting section of the apparatus of FIGURE 2 viewing the unit from the right.

Referring to FIGURE 1, an electrostatic gas cleaning apparatus 10 is shown with air flowing from left to right through the unit as would be the case in a conventional forced air conditioning system. An ionization section 11 on the upstream side of the unit is of a conventional type. Section 11 contains a plurality of spaced parallel plates 13 connected to the negative side of a source of direct current high voltage. Spaced in between the parallel plates 13 are charged wires 14 which are connected to the positive side of the source of voltage. As the gas

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or air flows into the ionization section, foreign particles of material are charged.

Collection or collecting section 12 which is located downstream section 11 comprises two sets of parallel spaced plates, 15 and 16 as shown in FIGURE 2. The set of plates made up of plates 15 is connected to the positive side of the source of high voltage, and the set of plates made up of plates 16 is connected to the negative side of the source of power. With the oppositely charged adjacent plates, the particles of foreign material which were charged in the ionization section are attracted to the oppositely charged plate in the collecting section. When the charged particle loses its charge, the particle remains on the plate. After the unit has been in service for a predetermined time, the plates of the collection section 12 become dirty. The unit 10 is then washed in a conventional manner to remove the dirt and foreign material from the plates.

Referring specifically to collecting section 12 of FIGURE 1, the ends of the plates are held in an insulator 20 which is only shown at the upper end in FIGURE 1. Since the other end is the same, only the upper end is shown in the drawing. Insulator 20 is an elongated member disposed substantially transversely to the direction of gas flow and at the upper end of the collector plates. It has a generally T-shaped cross-section with a base portion 20a and a high portion or leg 21 extending upwardly therefrom. A plurality of equally spaced slots extend on opposite sides of the high portion as shown in FIGURE 3. One set of slots or notches 22 is for receiving the ends of plate 16, and the opposite set of notches 23 is for receiving the ends of plates 15. As seen in FIGURE 3, the slots 23 are longitudinally displaced from slots 22 by a distance equal to approximately one-half the distance between adjacent slots.

The underside of insulator member 20 contains a plurality of projections 30 which are spaced to receive the plates 15 and 16. The projections 30 are shown in FIGURES 1, 2, and 3. As best seen in FIGURE 3, each of the spaces between projections 30 corresponds to one of the slots 22 or 23 and is co-extensive therewith. When the plates are assembled in the end members 20, a small notch or bump 31 on each plate provides a thickening portion so the plate is held between adjacent projections 30.

When the sets of plates 15 and 16 are made, each set is stamped or cut from a solid sheet of material with a common portion on each end of the plates which extends between all of the plates of that set. The set of plates made up of plates 16 has a common portion 32 at the upper end which is co-extensive with each of the plates at the upstream edge and extends with the plate a distance somewhat less than one-half the width of the plate. From this point on the end of the plate, portion 32 extends in a diagonal direction to the upstream edge of the next adjacent plate as shown in FIGURE 3. On the opposite side of the high portion 21 of the end member, another common portion 33 extends in a similar manner between the ends of plates 15. When the ends of the two sets of plates are connected to the source of power as shown in FIGURE 1, the interconnecting portions 32 and 33, respectively as shown in FIGURE 3, provide the electrical connection between all of the plates of each set. As mentioned before, the other end of unit 10 has a similar construction. The electrical connection is quite rigid since it is made up of the integral portions of the plates themselves, and there is no need for interconnecting of the plates after they are assembled by soldering wires or connecting mechanical connections. With such a common interconnecting member as 32 and 33, the cost of manufacture of such an electrostatic gas cleaner is greatly

reduced as the degree of inspection to insure that proper electrical connection is made is reduced.

With electrostatic gas cleaners using soldered wires or mechanical connectors between plates of a set in the collecting section, unless the connection was made with a high degree of workmanship, the connections often become loose under the stresses which are present with high voltage gradients across the different portions of the unit. Even soldered or mechanical connections which are not loose interpose an electric resistance in the power supplying circuit which requires higher supply voltages. Once a connection becomes loose, not only is a portion of the cell rendered inactive but high voltage arcing and noise due to electrical frequency humming can be present. In a gas cleaning apparatus, the presence of noise by electrical humming can be quite objectionable.

In the present invention, the plates of one set of the collecting section can be stamped from a sheet of material with the common portion interconnecting the plates, and when the plates are assembled in the end portions 20 the common portions 32 and 33 not only support the plates but maintain the electrical connection. Not only does the present invention reduce the chances of electrical failure and troubles due to loose connections, but the efficiency of the unit with predetermined voltage level is increased as there is less voltage drop in the connections.

While the present invention has been described in one particular manner, the invention is to be limited only by the scope of the appended claims.

I claim:

1. A collector section for an electrostatic gas cleaner adapted to have gas flow therethrough to be cleaned, the collector section comprising: a pair of elongated end insulating members, each of said members having a generally T-shaped cross-section including a base portion and a leg portion extending therefrom, said base portion having formed therein a plurality of substantially equally spaced transversely extending slots on each side of said leg portion, the slots on one side of said leg portion being longitudinally displaced from those on the other side of said leg portion by a distance equal to substantially one-half the distance between said slots, a plurality of spaced projections extending from said base portion in a direction opposite to said leg portion, each one of the spaces between said projections corresponding to, and being co-extensive with, one of the slots in said base portion, said end insulating members being disposed transversely to the direction of gas flow and in a generally spaced parallel relationship with said leg portions of said members extending in opposite directions therefrom and generally outwardly from the collector; first and second sets of spaced parallel sheet metal collector plates, all of the plates of a single set forming a unitary structure having a common portion at each end of said plates, said common portion being co-extensive with each of said plates from one edge thereof and extending to a position less than one-half of the distance along the end of the plate and then extending as a narrow strip in a direction substantially diagonally to said plates to the corresponding edge of the next adjacent plate of that set, said common portions providing a low resistance, mechanical and electrical connection between each of the plates of a single set, said first and second sets of plates being interleaved with the plates of one set being positioned in the slots on one side of the leg portions of said insulating members and in the corresponding spaces between the projections thereon, and the plates of the other set being positioned in the slots on the other side of the leg portions on said insulating members and in the corresponding spaces between the projections thereon so that the common portions of said one set of plates are maintained on said one side of the leg portions of said end insulating members and the common portion of said other set of plates is maintained on said other side of said leg portions, and so that the plates of said first and second sets are alternately disposed in a

spaced parallel relationship; and means adapted to connect the common portions of said first and second sets of plates to opposite sides of a source of power.

2. A one-piece parallel plate structure for an electrostatic gas cleaner comprising: a plurality of spaced parallel plates constructed of a continuous sheet of conductive material and of a generally rectangular shape, said plates forming a unitary structure having a portion common to each of said plates at one end thereof to connect each of said plates at said one end, said common portion including a portion co-extensive with said one end of each of said plates and extending from one edge of each of said plates to an intermediate position only a portion of the distance across said one end thereof, said common portion further including a portion extending between each two adjacent plates, bent with respect to said co-extensive portions, and formed as a narrow strip extending generally diagonally to said plates from the co-extensive portion at said one edge of each of said plates to the co-extensive portion at the intermediate position on the next adjacent one of said plates, said common portion providing a low resistance electrical and mechanical connection between said plates.

3. A collector section for an electrostatic gas cleaner comprising: first and second sets of spaced parallel collector plates, each of said sets of plates being constructed of a continuous sheet of conductive material and being adapted to be connected to opposite sides of a power supply, said first and second sets of plates being substantially similar in construction, all of the plates of a single set forming a one-piece structure having a portion common to each of said plates on at least one end thereof to connect each of the plates of that set at said one end, said common portion including a portion co-extensive with said one end of each of said plates to an intermediate position only a portion of the distance across said one end thereof, said common portion further including a portion extending between each two adjacent plates of a single set, bent with respect to said co-extensive portions, and formed as a narrow strip extending generally diagonally to said plates from the co-extensive portion, at said one edge of each of said plates, to the co-extensive portion, at the intermediate position, on the next adjacent one of said plates in that set, said common portion providing a low resistance mechanical and electrical connection between each of the plates of that set, said first and second sets of plates being interleaved so that the plates of said first and second sets are alternately disposed in a spaced parallel relationship; and insulator means maintaining said first and second sets of plates in position and electrically isolating said sets of plates from each other.

4. A collector section for an electrostatic gas cleaner comprising: first and second sets of spaced parallel collector plates, each of said sets of plates being constructed of a continuous sheet of conductive material and being adapted to be connected to opposite sides of a power supply, said first and second sets of plates being substantially similar in construction, all of the plates of a single set forming a one-piece structure having a portion common to each of said plates on at least one end thereof to connect each of the plates of that set at said one end, said common portion including a portion co-extensive with said one end of each of said plates and extending from one edge of each of said plates to an intermediate position only a portion of the distance across said one end thereof, said common portion further including a portion extending between each two adjacent plates of a single set, bent with respect to said co-extensive portions, and formed as a narrow strip extending generally diagonally to said plates from the co-extensive portion, at said one edge of each of said plates, to the co-extensive portion, at the intermediate position, on the next adjacent one of said plates in that set, said common portion providing a low resistance mechanical and electrical connection between each of the plates of that set, and an elongated end

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insulating member, said member having first and second longitudinally extending edges, a plurality of substantially equally spaced transversely extending slots extending inwardly from each of said edges, the slots on one edge of said member being longitudinally displaced from those on the other edge by a distance less than the distance between said slots, said end insulating member being disposed transversely to said plates with said slots extending in a direction generally parallel to said plates, said first and second sets of plates being interleaved with the plates of one set being positioned in the slots on one edge of said insulating member and the plates of the other set being positioned in the slots on the other edge of said insulating member so that the plates of said first and second sets are alternately disposed in a spaced parallel relationship.

5. A collector section for an electrostatic gas cleaner adapted to have gas flow therethrough to be cleaned, the collector section comprising: a pair of elongated end insulating members, each of said members having first and second oppositely disposed longitudinal edges, a plurality of substantially equally spaced transversely extending slots extending inwardly from each of said edges, the slots on one edge being longitudinally displaced from those on the other edge by a distance less than the distance between said slots, said end insulating members being disposed transversely to the direction of gas flow and in a generally spaced parallel relationship; first and second sets of spaced parallel collector plates, each of said sets of plates being constructed of a continuous sheet of material, said first and second sets of plates being substantially similar in construction, all of the plates of a single set forming a one-piece structure having a portion common to each of said plates on at least one end thereof to connect each of the plates of that set at said one end, said

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common portion including a portion co-extensive with said one end of each of said plates and extending from one edge of each of said plates to an intermediate position less than one-half of the distance across said one end thereof, said common portion further including a portion extending between each two adjacent plates of a single set, bent with respect to said co-extensive portions, and formed as a narrow strip extending generally diagonally to said plates from the co-extensive portion, at said one edge of each of said plates, to the co-extensive portion, at the intermediate position, on the next adjacent one of said plates in that set, said common portion providing a low resistance mechanical and electrical connection between each of the plates of that set, and said first and second sets of plates being interleaved, with the plates of one set being positioned in the slots on one edge of said insulating members and the plates of the other set being positioned in the slots on the other edge of said insulating members so that the plates of said first and second sets are alternately disposed in a spaced parallel relationship; and means adapted to connect the common portions of said first and second sets of plates to opposite sides of a source of power.

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