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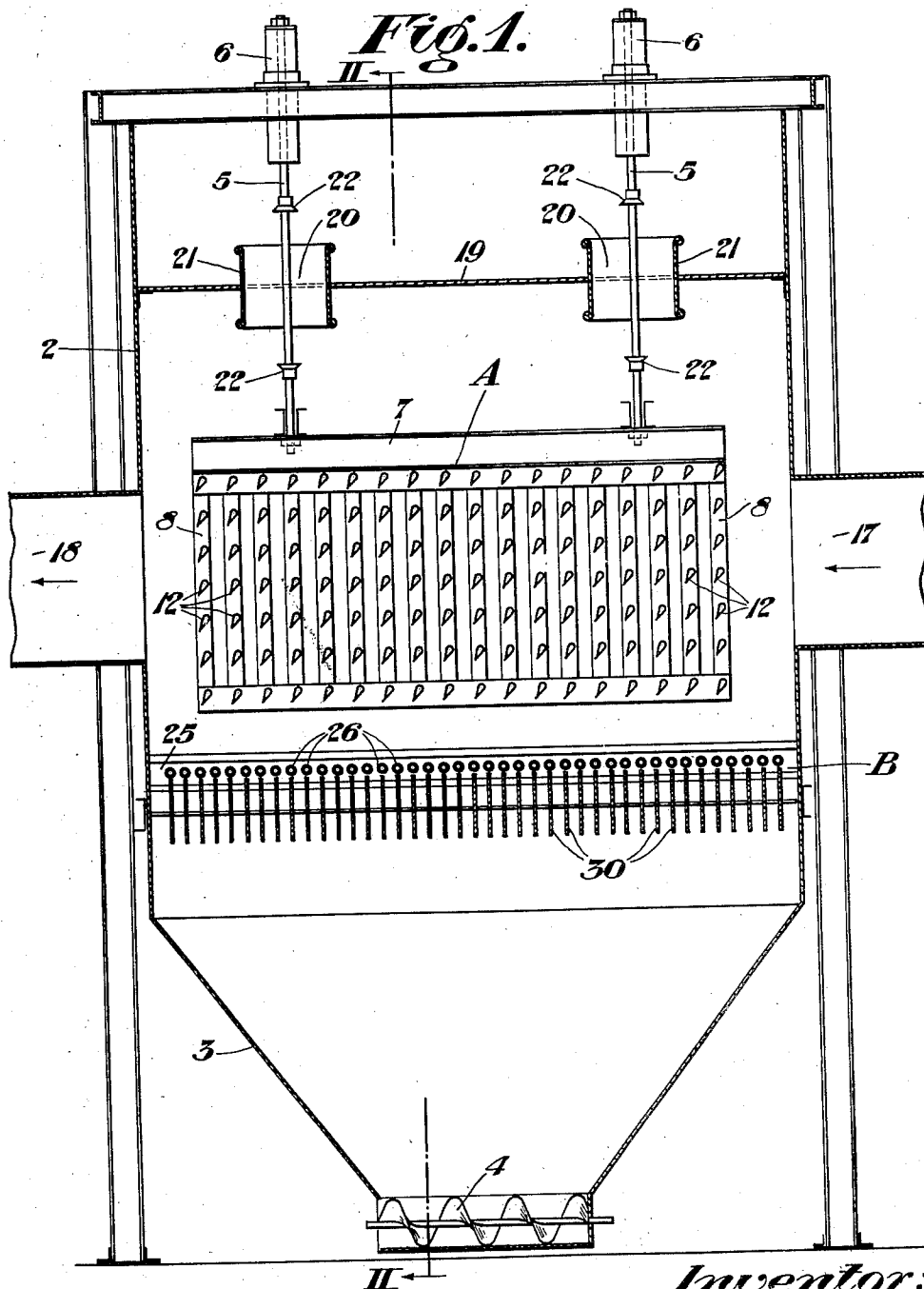
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METHOD OF AND APPARATUS FOR CLEANING GASES

Filed April 27, 1931

3 Sheets-Sheet 1



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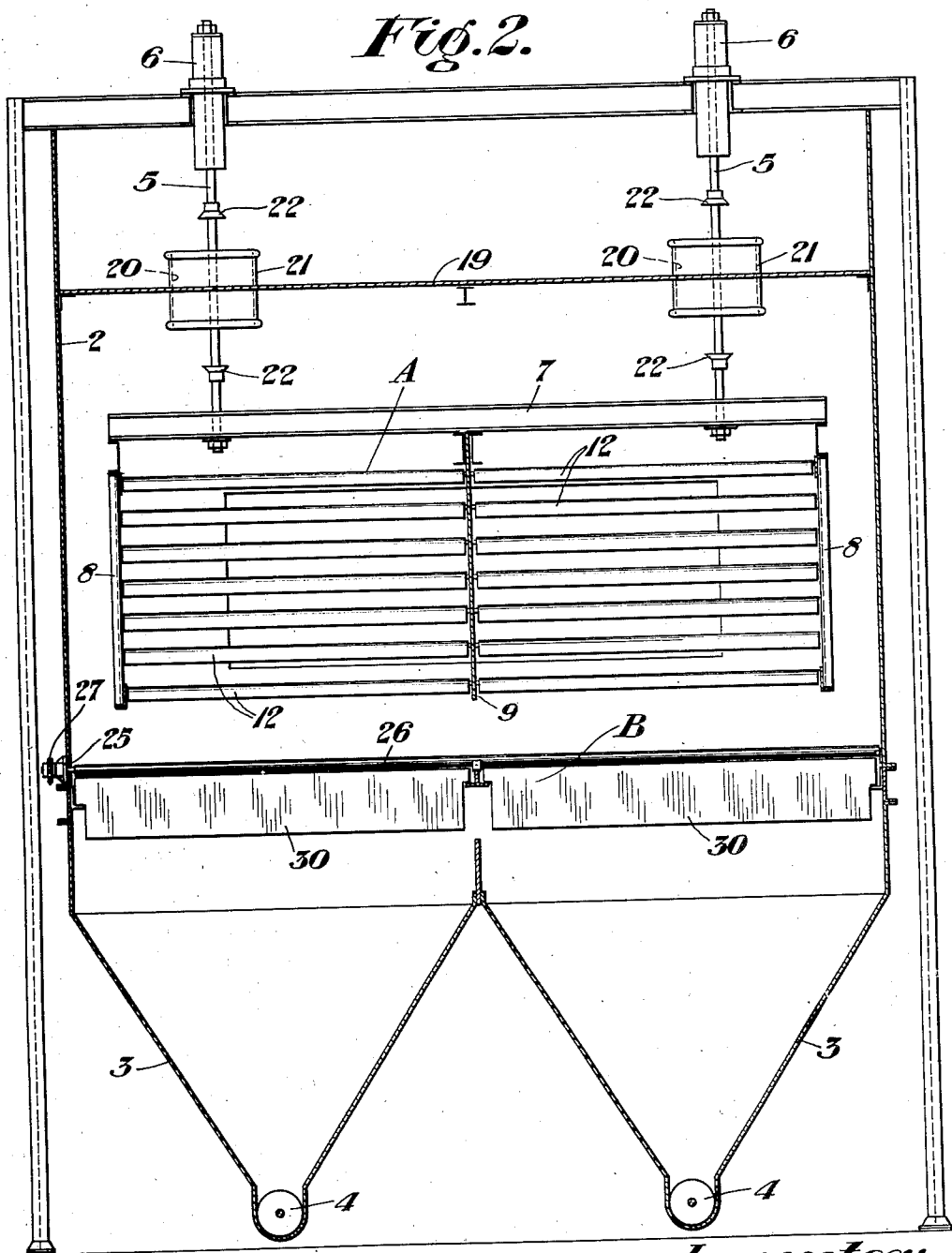
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METHOD OF AND APPARATUS FOR CLEANING GASES

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3 Sheets-Sheet 2

*Fig. 2.*



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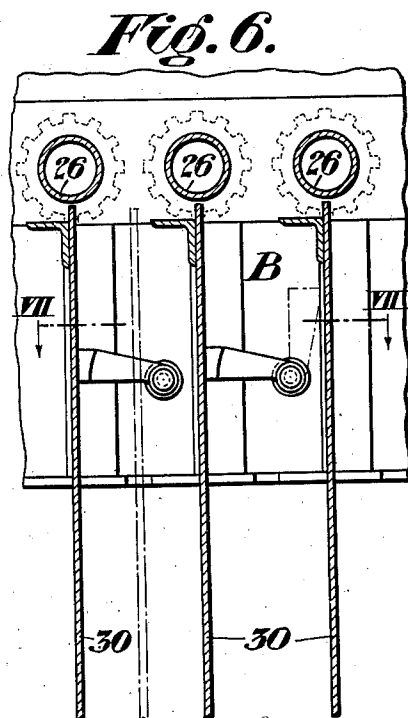
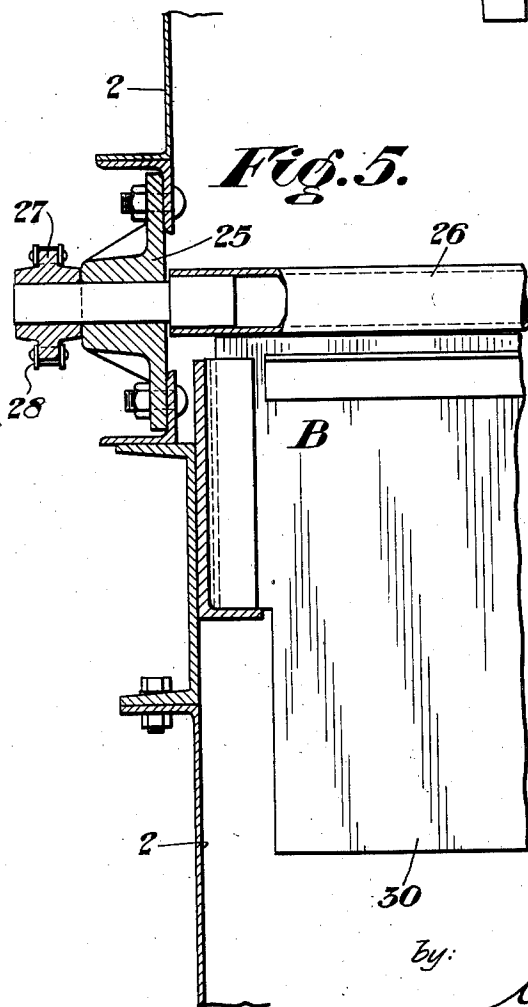
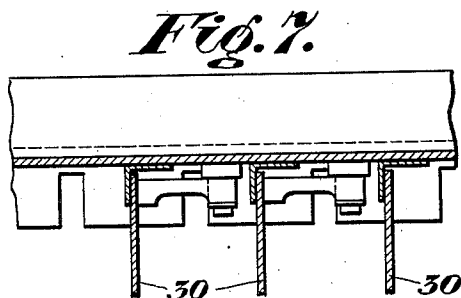
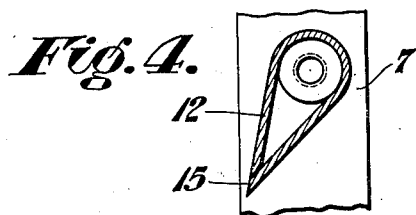
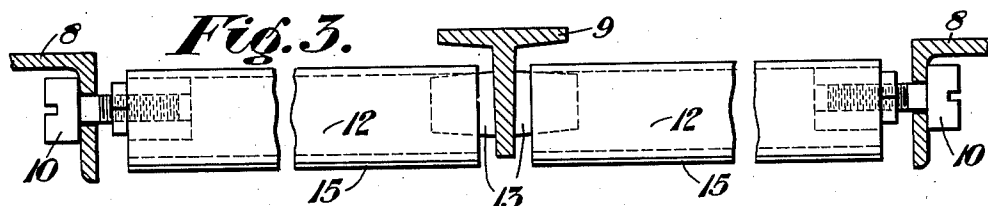
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METHOD OF AND APPARATUS FOR CLEANING GASES

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3 Sheets-Sheet 3



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## UNITED STATES PATENT OFFICE

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## METHOD OF AND APPARATUS FOR CLEANING GASES

Application filed April 27, 1931. Serial No. 533,310.

This invention relates to a method of and apparatus for separating solid and liquid particles from fluid streams and, while not limited thereto, is particularly adapted for separating solid and liquid particles from gaseous fluid streams.

This invention has for its object the provision of a novel form of apparatus for producing flow bodies of electric wind and the provision of a novel method of using said wind to separate the solid and liquid particles from the fluid stream.

Another object is to provide a novel arrangement of discharge and grounded electrode units whereby the electrode elements of said discharge electrode unit will serve as baffles and deflectors and also will be wiped by the fluid stream so as to preionize said stream, and said grounded electrode unit will prevent splashing of the particles separated out of the fluid stream.

A further object is to provide means for maintaining the surfaces of the several elements of said grounded electrode unit clean.

Figure 1 is a sectional side elevation of an apparatus constructed in accordance with this invention.

Figure 2 is a sectional elevation taken at right angles to Figure 1.

Figure 3 is an enlarged fragmentary plan showing the mounting for the discharge electrodes.

Figure 4 is an enlarged cross-sectional view through one of the discharge electrodes.

Figure 5 is an enlarged fragmentary elevation showing the grounded electrode mounting and scraper arrangement.

Figure 6 is an enlarged fragmentary elevation of the structure of Figure 5 taken at right angles to Figure 5.

Figure 7 is a sectional plan on the line VII-VII of Figure 6.

Referring more particularly to the drawings, the numeral 2 designates the casing or housing which is preferably rectangular in plan and enclosed on all sides to form a gas or fluid-tight structure. The bottom of the housing 2 is in the form of hoppers 3 having screw conveyor discharge members 4 therein

for conveying the separated and trapped particles out of the hoppers.

A discharge electrode unit A is suspended from the top of the casing or housing 2 by rods 5 carried by compression insulators 6. The unit A comprises a frame 7 having vertically disposed horizontally spaced angle-iron members 8 along each side and T-shaped center supports 9. The angle-iron members 8 are slotted to receive mounting pins 10 carried by the outer ends of the electrode elements 12 and the T-shaped center supports carry lugs or pins 13 adapted to be fitted in bearing blocks in the inner ends of the electrode elements.

While in the structure shown the electrode unit is of such size that the span is too great for a continuous electrode element and, therefore, two electrode elements are shown in line supported at the center by the T-member 9, I do not wish to be limited thereto since in smaller structures one electrode element may span the whole unit A.

The electrode elements 12 are preferably of carrot-shape in cross-section and are formed from sheet metal which is bent upon itself with one edge 15 beveled to form a sharp discharge edge. The relatively flat sides and rounded upper portions of the elements are such as to suppress corona and cause substantially all the ions to discharge from the sharp edges 15 which, due to the arrangement of the electrode elements, is directed toward the grounded electrode unit B.

The electrode elements 12 are arranged in vertically spaced horizontal rows with the electrode so arranged that the discharge from the elements of one row is directed between the elements of the next adjacent row.

The casing 2 is provided with an inlet conduit 17 for dirty gas and an outlet conduit 18 for clean gas.

The electrode elements 12 are inclined downwardly and in the direction of flow of the gas stream so that they serve as deflectors and baffles for the incoming stream of dirty gas, which gas wipes over the elements and thereby becomes preionized sufficiently to materially aid in the separation of the solid and liquid particles therefrom.

A diaphragm or ceiling wall 19 is provided at a point intermediate the top of the casing 2 and the discharge electrode unit A to prevent the dirty gas rising up around the insulators 6 and depositing foreign matter thereon, which may cause a breaking down of the insulators. The wall 19 is provided with openings 20 through which rods 5 pass. The openings 20 are surrounded by shields or collars 21 which are connected directly to the grounded wall 19. Discharge collars 22 are mounted on the rods 5 from which ions are discharged toward the edges of the shields 21 forming a curtain-like discharge to throw down any dust or other particles tending to flow up through the openings 20.

The grounded electrode unit B comprises a supporting structure 25 in which is journaled a plurality of tubular electrode elements 26 which are provided with sprockets 27 connected by a drive-chain 28 to a motor (not shown) by which the electrode elements may be rotated for cleaning off any deposits.

Suitable scraper bars 30 are mounted below each of the grounded electrode elements 26 and are in contact with the electrodes so that when said electrodes are rotated any deposits on their surfaces will be removed.

The scraper bars extend downwardly below the electrode elements 26 for an appreciable distance so as to serve as baffles and prevent any circulation of the gases immediately below the grounded unit B.

In carrying out the method of this invention the discharge electrode unit A is connected through one or more of the rods 5 to one side of a high potential electric circuit while the housing 2 and grounded electrode unit B is connected to the ground.

The dirty fluid or gases pass into the casing or housing 2 through the conduit 17 and immediately impinge against and wipe over the discharge electrode elements 12 which are discharging streams of ions toward the grounded electrode elements 26. This wiping action of the dirty fluid over the electrodes preionizes the gas or fluid and aids materially in the separation of the solid and liquid particles.

The discharge electrodes 12 produce a field of intense ionization from their edges 15 due to ionic collisions with molecules of the gas or fluid. This ionization results in the formation of a large number of small ions. Ions of molecular size and of the same sign of charge as the edges 15 of the electrodes 12 will be repelled from the edges with a velocity of thousands of centimeters per second and in great numbers. These ionic currents thus set up are of sufficient intensity and volume to drag a considerable amount of air and fluid with them so as to form what is known as "electric wind" which flows from the edges 15 in the form of flow bodies toward the grounded electrode elements 26.

The dirty gases or fluid entering the apparatus through the conduit 17 are forced to flow across the several streams of electric wind produced by the several electrode elements 12, whereby all the dust or other solid or fluid particles are carried out of the stream of fluid by the electric wind and trapped between the grounded electrodes 26.

The electrode elements 12 all produce a unilateral discharge so that the streams of electric wind are all directed toward the grounded electrode elements 26. This forms a curtain of successive streams or sheets of electric wind which insures complete separation of particles from the fluid being cleaned.

Electric wind can only be produced from charged electrodes having points or sharp edges facing a grounded element and in which corona discharge is suppressed. In the region of a point or sharp edge charged to a high potential the electric field will be very intense so as to cause the small number of ions initially in the fluid to be cleaned to move with sufficient velocity to produce secondary ionization. Ions having the same sign of charge as the point will be repelled by it, as heretofore stated, dragging air with them forming electric wind.

The electric wind of this application is not to be confused with corona, which is a luminous discharge from all sides of a conductor or electrode and which depends entirely upon ionization alone for its separating action, since the discharged energy is dissipated from all surfaces rather than concentrated from a single edge or point, and, therefore, the ions are not repelled with sufficient force to drag air with them.

While I have disclosed certain specific embodiments of my invention it will be understood that I do not wish to be limited thereto since various modifications may be made without departing from the scope thereof, as defined in the appended claims.

I claim:

1. In an electric precipitator for precipitating solid and liquid particles from a stream of fluid flowing therethrough, the combination of a discharge electrode unit and a grounded electrode unit, said discharge electrode unit comprising a plurality of vertically and horizontally spaced discharge elements, each of said elements having an enlarged body portion and a sharp discharge edge directed toward said grounded electrode unit, so as to cause a unilateral discharge of ions from all of said discharge electrode elements toward said grounded electrode unit forming an electric wind.

2. In an electric precipitator for precipitating solid and liquid particles from a stream of fluid flowing therethrough, the combination of a discharge electrode unit and a grounded electrode unit, said discharge electrode unit comprising a plurality of vertically

and horizontally spaced discharge elements, each of said elements being inclined toward said grounded electrode unit and in the direction of flow of the stream of fluid being acted upon so as to mechanically deflect and baffle said fluid stream, said elements each having an enlarged body portion and a sharp discharge edge directed toward said grounded electrode unit, so as to cause a unilateral discharge of ions from all of said discharge electrode elements toward said grounded electrode unit forming an electric wind.

of said stream of fluid, and trapping said particles.

In testimony whereof, I have hereunto set my hand.

ARTHUR F. NESBIT.

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10 electrode elements toward said grounded electrode unit forming an electric wind.

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15 3. In an electric precipitator for precipitating solid and liquid particles from a stream of fluid flowing therethrough, the combination of a discharge electrode unit and a grounded electrode unit, said discharge electrode unit comprising a plurality of vertically and horizontally spaced discharge elements, each of said elements having an enlarged body portion and a sharp discharge edge directed toward said grounded electrode unit, so as to cause a unilateral discharge of ions from all of said discharge electrode elements toward said grounded electrode unit forming an electric wind, and said grounded unit comprising a plurality of spaced curved surfaces which permit the separated particles to be blown around and between them.

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30 4. In an electric precipitator for precipitating solid and liquid particles from a stream of fluid flowing therethrough, the combination of a discharge electrode unit and a grounded electrode unit, said discharge electrode unit comprising a plurality of vertically and horizontally spaced discharge elements, each of said elements having an enlarged body portion and a sharp discharge edge directed toward said grounded electrode unit, so as to cause a unilateral discharge of ions from all of said discharge electrode elements toward said grounded electrode unit forming an electric wind, said grounded unit comprising a plurality of spaced rotary cylindrical members which permit the separated particles to be blown between them, and scraper bars arranged on the side of said cylindrical members opposite said discharge electrode elements and adapted to scrape any deposited particles from said cylindrical members, said scraper bars being of considerable width so as to serve as baffles.

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55 5. The method of separating solid and liquid particles from a fluid stream which consists in passing said fluid stream across the path of successive flow-bodies of electric wind so as to force the major portions of said particles toward one side of said stream, said flow-bodies of electric wind increasing in density in the direction of the movement of said particles so as to effectively force the increasing accumulation of said particles out

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