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CENTRIFUGAL GAS CLEANING APPARATUS.

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1,381,719.

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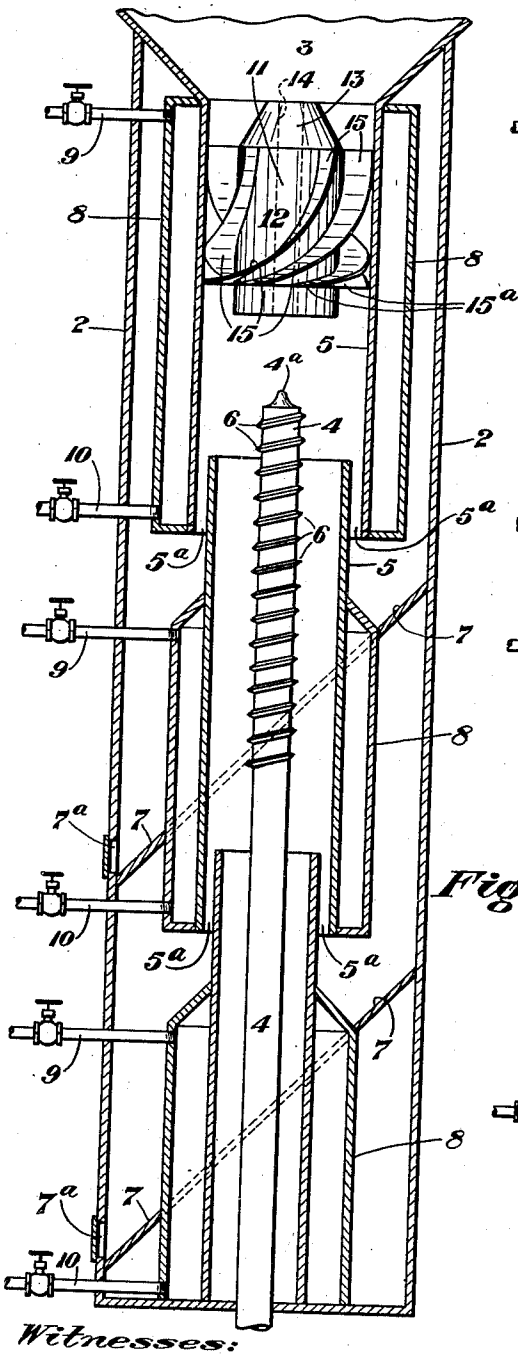

Fig. 1.

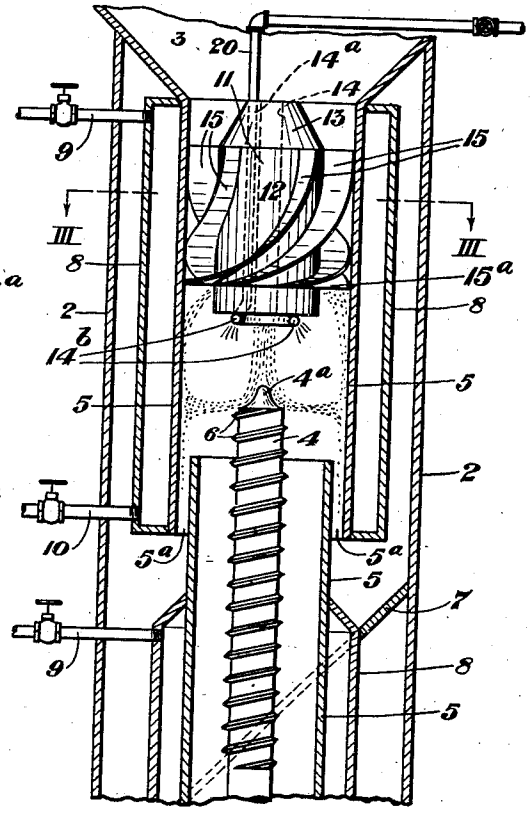

Fig. 2.

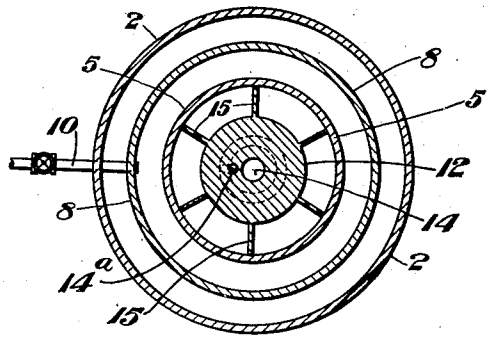

Fig. 3.

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UNITED STATES PATENT OFFICE.

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CENTRIFUGAL GAS-CLEANING APPARATUS.

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To all whom it may concern:

Be it known that we, FRANK R. McGEE and ARTHUR F. NESBIT, citizens of the United States, and residents, respectively, of Steubenville, in the county of Jefferson and State of Ohio, and Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Centrifugal Gas-Cleaning Apparatus, of which the following is a specification.

This invention relates to centrifugal head members adapted to be used in gas cleaning apparatus of the form used in separating liquid particles from gaseous and fluid streams by electrical precipitation, and has for its principal object the provision of such a head, having means for increasing the effectiveness of the ionization forces in the cleaner.

Cleaners of the type to which our invention belongs, comprise opposing electrode systems having tubular collecting electrodes. Heretofore, suitable centrifugal heads have been applied in or near the tops of the tubular collecting electrodes, having helical vanes forming helical passages to cause a swirling action of the gases as they enter between the electrodes.

It is the object of our present invention to improve this construction of centrifugal head by providing a centrally arranged direct lead opening in the head to permit a small amount of dirty vapor laden gases to enter and impinge directly on the top of the discharge electrode, thereby causing an initial ionization of these gases in advance of the main volume and setting up an outward precipitating movement of the liquid or collected vapor particles which will materially aid in the separation of the particles from the main flow.

Another object is to construct the discharge electrode in a novel manner so that it will facilitate the precipitation of the particles from the small central flow of gases which impinge thereon.

These and other objects will be fully brought out and will be apparent from the following specification, and will be illustrated in the accompanying drawings, in which:

Figure 1 is a longitudinal sectional, somewhat diagrammatic view of an apparatus embodying our invention, and,

Fig. 2 is a similar view of a slightly modified form of apparatus.

Fig. 3 is a horizontal sectional view on the line III—III of Fig. 2.

Referring to the drawings, the numeral 2 designates a casing having a receiving chamber 3 at its upper end (shown broken away in the drawings).

The casing 2 is adapted to house or contain a suitable opposing electrode system which forms a series of ionization fields. Such system is composed of a discharge electrode 4 arranged concentrically within a tubular collecting electrode 5.

The discharge electrode 4 is preferably in the form of a rod having edges 6 spaced along its periphery forming fields composed of individual ionization zones, and having its upper end pointed or beveled as at 4^a.

The collecting electrode 5 is formed of a plurality of tube sections, each section being of less diameter than the preceding section, and being so arranged that the smaller section telescopes an appreciable distance within the preceding larger section, thus forming exits or traps 5^a to allow the escape of the collected matter from the section of the electrode immediately preceding or above the trap.

The electrodes 4 and 5 may be supported in position in any suitable manner from their lower ends.

Suitable collecting partitions 7 are arranged on an angle within the casing 2 below each of the traps 5^a and are adapted to collect the precipitated products discharged through the traps. An outlet 7^a is formed in the casing adjacent the lowest edge of the partitions 7 to allow for the removal of the collected matter.

Cooling or refrigerating jackets 8 are concentrically arranged around each of the sections of the collecting electrode 5 to cause a condensing of the vapors carried in the gases being cleaned, forming a fog-like mist of liquid particles, and to generally lower the temperature of the gases as they pass through the ionization zones formed in the space between the electrodes. The jackets 8 are each provided with inlet pipes 9 and outlet pipes 10 each of which are provided with suitable regulating valves to permit circulation of a cooling fluid.

An improved and novel direction imparting head member 11 is mounted within the

upper end of the collecting chamber, and our invention relates particularly to this member together with the other novel features of the structure set forth.

The head 11 comprises a central body portion 12 having its upper edge beveled, forming a substantially conical top portion 13 and having a relatively small centrally arranged passage or opening 14 formed therein. A plurality of helical vanes 15 are formed around the outer periphery of the body portion 12, and have their lower ends contracted forming nozzle-like terminals 15^a, of such width that they will snugly abut the inner periphery of the tubular collecting electrode 5 forming helical passages for the incoming gases.

The uncleaned gases will enter the chamber 3 at the upper end of the casing under pressure, and will be forced to pass through the passages formed by the helical vanes 15 and the opening 14 in the head 11. The passages formed by the vanes 15 being comparatively large, the major portion of the gases will pass therethrough and will be given a whirling movement. However, a small or lead stream of the gases will flow through the unrestricted small opening 14 and impinge directly on the upper pointed end 4^a of the discharge electrode 4. The effect of this small or lead stream of gases impinging directly on the point of the discharge electrode will be to initially ionize such stream at a point above the normal ionization zones and, therefore, precipitate the fog or liquid particles with which it is laden toward the surrounding collecting electrode and into the path of the oncoming gases that have passed between the vanes 15. The effect of precipitating the particles of this initially ionized stream into the path of the oncoming unclean and vapor laden gases will serve a two-fold purpose, first the precipitated fog or liquid particles will form a nucleus for collecting the vapor particles in the oncoming unclean gases, and second—it will cause an initial ionization zone at this point of more intensity than could otherwise be formed, therefore, causing a more perfect cleaning of the gases.

As has been said, the major portion of the gases will pass through the passages formed by the helical vanes and will, therefore, have a swirling or centrifugal movement. This centrifugal movement has a tendency to throw off the heavier particles carried by the gases due to the mechanical forces. However this is materially aided by the forces of the initial ionization zone formed by the lead stream of gases. The successive ionization zones will continue to clean the gases of all liquid particles as they pass through between the electrodes.

The modification shown in Figs. 2 and 3 is similar in all respects to the construction heretofore described, with the exception that a pipe 20 is passed through a second passage or aperture 14^a to the one side of the aperture or passage 14, and is provided at its lower end with nozzles 14^b. Pipe 20 leads from a suitable source of fluid supply, the fluid preferably being of a similar nature to that carried in suspension in the gases, and which it is desired to remove. The fluid is forced through the pipe 20 and nozzles 14^b and becomes mixed with the gases coming through the passage 14, and is forced or precipitated outward with said gases into the stream of oncoming unclean gases similar to the lead stream of gases described above.

This latter construction is principally used when there is a small percentage of vaporized matter carried in the gases or such matter is in a highly vaporized state.

After the particles have been ionized by either of the above apparatus and they are precipitated against the collecting electrodes, they will escape through the traps 6 onto the collecting partitions 7 where they are retained until drawn off through the outlets 7^a.

Various modifications will readily suggest themselves to those skilled in the art. Therefore it will be understood that we do not wish to be limited to the specific constructions shown, except as expressly limited in the appended claims.

We claim:

1. In an apparatus for separating foreign particles from gaseous streams, the combination with a receiving chamber for the gases to be cleaned, and a tubular conduit leading therefrom, of a centrifugal head member mounted in said tubular conduit, said head comprising a body portion having a centrally arranged aperture therethrough, and a plurality of helical passages around its periphery, the major portion of the gases entering said chamber being adapted to pass through said helical passages and a minor portion being adapted to pass through said centrally arranged aperture.

2. In an apparatus for electrically precipitating particles from gaseous streams, a head member adapted to cause a mechanical centrifugal movement to the major portion of the gases, said head comprising a body portion having a relatively small centrally arranged aperture therethrough, and a plurality of helical vanes formed on the outer periphery of said body portion forming helical passages, the major portion of the gases being adapted to pass through said helical passages and a minor portion being adapted to pass through said small centrally arranged aperture forming a lead stream.

3. In an apparatus for electrically pre-

cipitating particles from gaseous streams, the combination with a tubular collecting electrode and a discharge electrode centrally arranged within said collecting electrode, of a centrifugal head member adapted to impart a mechanical centrifugal movement to the major portion of the gases, said head being arranged within said collecting electrode and above said discharge electrode, and comprising a cylindrical body portion having a relatively small centrally arranged unrestricted aperture therein adapted to admit a small lead flow of uncleaned gases through the head to impinge directly upon the upper end of the discharge electrode, and a plurality of helical vanes formed on the outer periphery of said body portion adapted to abut the inner periphery of said collecting electrode, thereby forming helical passages through which the major portion of said gases are adapted to pass.

4. An apparatus for separating particles from gaseous and fluid streams by electrical precipitation, comprising the combination with a casing, of a tubular collecting electrode arranged within said casing and having a plurality of traps spaced along its length, a discharge electrode centrally arranged within said collecting electrode, and a centrifugal head member adapted to impart a mechanical centrifugal movement to the major portion of the gases, said head being arranged within said collecting electrode and above said discharge electrode, and comprising a cylindrical body portion having a relatively small centrally arranged unrestricted aperture therein adapted to admit a small lead flow of uncleaned gases through the head to impinge directly upon the upper end of the discharge electrode, and a plurality of helical vanes formed on the outer periphery of said body portion adapted to abut the inner periphery of said collecting electrode, thereby forming helical passages through which the major portion of said gases are adapted to pass.

5. The method of precipitating particles from gaseous fluids, comprising first, in passing the gases into a chamber, dividing said gases into two flow bodies, imparting a mechanical centrifugal whirl to one of said bodies and passing it between a discharge electrode and a collecting electrode, and passing said other body directly against the discharge electrode, causing an initial ionization thereof, and precipitating the particles therefrom toward said collecting electrode and into the path of said first body.

6. The method of precipitating particles from gaseous fluids, comprising, first, in passing the gases into a chamber, dividing said gases into two flow bodies, passing one of said bodies through helical passages imparting a mechanical centrifugal whirl thereto, and then passing it through ionization zones in the space between a discharge electrode and a collecting electrode, and passing said other body directly against said discharge electrode, causing an initial ionization thereof, and precipitating the particles therefrom toward said collecting electrode and into the path of said first flow body, thereby forming a nucleus for the particles of, and initially ionizing said first named flow body.

In testimony whereof we have hereunto signed our names.

FRANK R. McGEE.
ARTHUR F. NESBIT.