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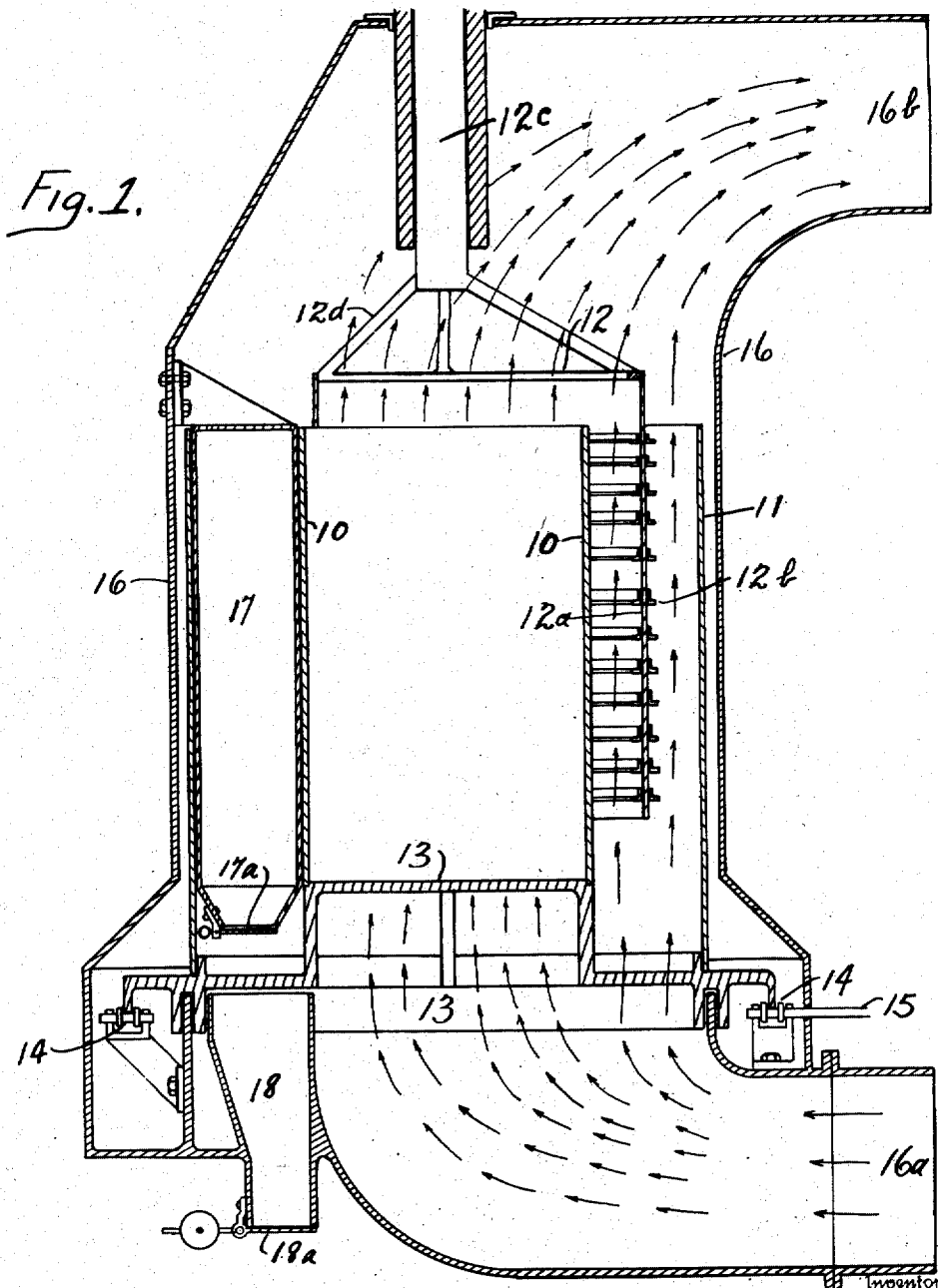
ART OF ELECTRICAL PRECIPITATION OF PARTICLES FROM FLUID STREAMS.

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2 SHEETS—SHEET 1.



Witnesses

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Fig. 2.

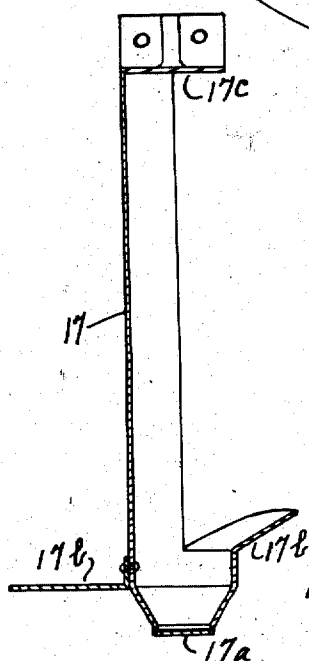
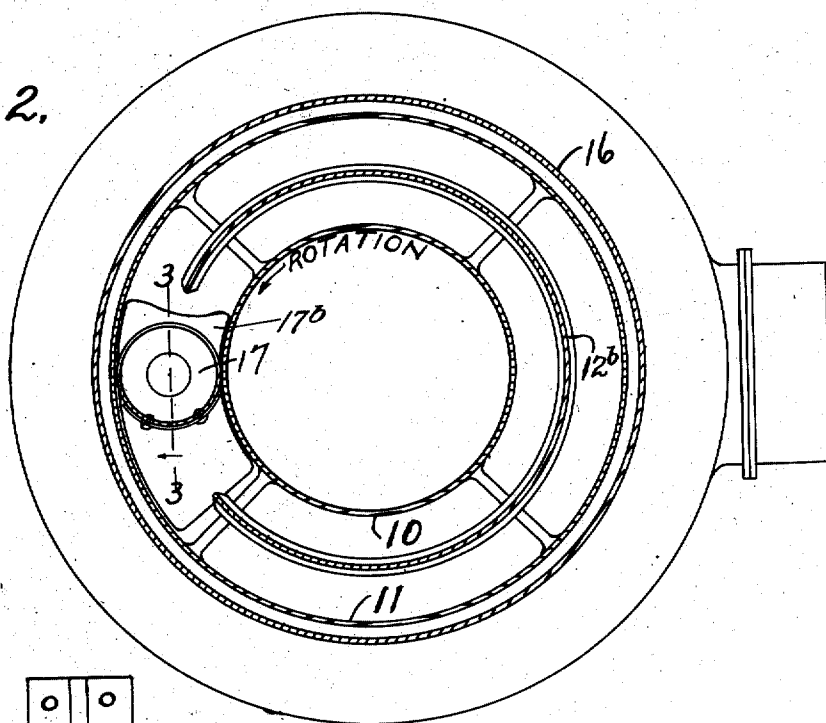


Fig. 3.

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ART OF ELECTRICAL PRECIPITATION OF PARTICLES FROM FLUID STREAMS.

1,252,104.

Specification of Letters Patent.

Patented Jan. 1, 1918.

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To all whom it may concern:

Be it known that I, CHARLES W. GIRVIN, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in the Art of Electrical Precipitation of Particles from Fluid Streams, of which the following is a specification.

My present invention relates to the art of electrical precipitation of particles from fluid streams.

Practice of this art involves the creation of an ionization field or fields in the flow path of a stream and collection of the deposits on the stream boundary or boundaries. The apparatus generally employed comprises opposing electrode systems spaced-apart with one system—termed the active electrode system—connected to a source of high potential, while the other system—termed the collecting electrode system—is generally grounded, although it may be connected to the opposite side of the source. These systems may operate with single or multiple streams, and may be illustrated by a cylindrical grounded pipe within which is an axially-extending wire connected to the source, the stream passing in the direction of length of the pipe and through the field formed between the pipe and wire. A preferred form of apparatus employs the corona type of discharge in producing the field, although other types have also been employed.

In practising this art under prior teachings, certain difficulties appear. For instance, one of the inherent results of the precipitation by a field of this character is that while deposits are collected on the stream boundary, such deposits will adhere thereto during activity of the field with the result that the deposits build up and decrease the distance between the electrodes to a point where disruptive discharges must and are formed across the field, practically short-circuiting the apparatus while the arc remains; this renders it difficult to operate the apparatus at a voltage approaching the break-down point—the most effective type of operation—since comparatively small collections will produce the disruptive discharge. If the voltage be decreased to avoid

this difficulty, the efficiency is reduced unless the rate of flow of the stream be greatly reduced, thus materially decreasing the capacity of the apparatus. While such change may increase the time between successive disruptive discharges they are not thereby avoided.

It has been contemplated to meet this by employing the disruptive discharge to dislodge the deposits, but this necessarily involves meeting the problem of preventing damage to apparatus by such discharges. Various other solutions have been contemplated, but, so far as I am aware, each advantage gained is at the sacrifice of some other advantageous feature, so that the combined result is approximately the same—high cleaning efficiency with low capacity, or the reverse. It is well known that a field of this type will produce the deposits and clean the stream, but the principal problem is apparently to clean the cleaner.

This problem of cleaning the cleaner is met in the present invention by not attempting to provide any cleaning action in the active portion of the field, but produce the deposit collection within the active portion of the field and shift the collecting surface into an inactive portion of the field where the deposits are removed, thus permitting such building-up of collected deposits but removing the collecting surface before the building-up action has reached a stage where the disruptive-discharge conditions are present. Obviously complete absence of disruptive discharge formations may not be provided—service conditions may provide an excess of precipitated deposits under abnormal conditions—but such discharge formations become the exception instead of the rule.

A preferred form of apparatus for carrying out the general principles of the invention is to employ a rotatable collecting electrode with a stationary active electrode, the two electrodes being relatively formed as to provide active and inactive portions of the ionization or electric field. By mounting a deposit-removing device in such inactive portion, the deposits collected in the active portion of the field are brought to the removing device and the collecting electrode more or less cleaned. Obviously, the elec-

trode may be movable in directions other than rotatable, and it is to be understood that the invention contemplates the various ways in which the collecting electrode may be shifted between active and inactive portions of the field.

To these and other ends, therefore, the nature of which will be readily understood as the invention is hereinafter disclosed, said invention consists in the improved methods of deposit precipitation and removal and the construction and combination of parts for carrying such methods into effect, as hereinafter more fully described, illustrated in the accompanying drawings, and more particularly pointed out in the appended claims.

In the accompanying drawings, in which similar reference characters indicate similar parts in each of the views,—

Figure 1 is a central vertical sectional view taken through an apparatus embodying the general principles of my invention, the structure forming one embodiment in which the general principles may be made serviceable.

Fig. 2 is a cross-sectional view with parts broken away.

Fig. 3 is a detail sectional view taken on line 3—3 of Fig. 2.

In the present embodiment, the field is shown as annular, and may be considered either as a single or a double field, dependent on whether the active electrode is in the form of a solid or skeleton structure. In either case the collecting electrode system is in the form of two concentrically arranged cylinders 10 and 11 between which is located the active electrode 12 which, in the form shown is in the form of a support 12^a—solid or skeletonized as may be preferred—carrying a plurality of edge-forming members 12^b suitably spaced apart and extending in planes which intersect the axes of the cylinders. The drawings show the members as extending in horizontal planes, but it is obvious that this may be varied to a more or less extent, as by having their directions of length more or less inclined to the horizontal. Members 12^b, in the form shown, are preferably on opposite sides of the support, cooperating with the opposing collecting electrode faces of cylinders 10 and 11.

As shown in Fig. 2, members 12^b do not complete the circle although the electrode is of a form concentric to cylinders 10 and 11. A gap is thus formed in the circle, which gap produces an inactive portion of the general ionization field the active portion of which lies between members 12^b and the opposing faces of the cylinders 10 and 11.

Electrode 12 is supported in suitable manner, as by a supporting member 12^c con-

nected to the electrode by a spider structure 12^d, a suitable portion of the electrode system being connected to a source of high potential (not shown). It is to be understood, of course, that the parts will be suitably insulated.

The collecting electrode system (cylinders 10 and 11) is mounted on a turn-table structure 13 of suitable configuration and supported on rollers 14 properly located to permit a rotative movement to the turntable. Such movement may be provided in any suitable manner, as by connecting one of the rollers to a rotatable shaft 15, the weight of the turntable and the parts carried thereby tending to produce sufficient friction to drive the turntable. Obviously, other ways of rotating the turntable or cylinders may be employed.

As shown, the turntable is arranged to close the interior of cylinder 10 from the flowing stream, while that portion of the turntable leading to the space between the cylinders may be more or less spider-like in form (Fig. 2) to permit the stream—entering from below—to pass into such space.

16 designates a casing within which the structure is located, the casing having an entrance 16^a and a discharge 16^b.

Mounted in the inactive gap of the field is a suitable deposit-removing device. In the drawings this is shown as a scraper 17 which has its advance edges in contact with or in juxtaposition to the deposit-collecting faces of the cylinders. The scraper may be of suitable cross-sectional contour, that shown being semi-circular within the inactive zone and forming a ready passage for the removed deposits which drop to the bottom of the scraper on to a suitable trap-door 17^a which permits passage of the deposits into a collecting chamber 18 which is also preferably closed by a trap-door 18^a.

To prevent as far as possible direct entry of the stream into the inactive space or gap of the field, I preferably employ a baffle 17^b at the lower end of the scraper and a baffle-like structure 17^c at the top of the scraper, baffle 17^b tending to direct the entering stream away from the position of the scraper, baffle 17^c tending to force any portion of the stream contents which may have shifted toward the scraper away from the space. In other words, the two baffles tend to close the opposite ends of the space immediately in front of the scraper portion so as to tend to reduce the flow or velocity of any stream contents therein, thus tending to decrease the quantity of such contents which would pass through the inactive portion of the field.

As will be understood scraper 17 is more or less illustrative. Other forms of devices, as for instance brushes, may be employed.

Members 12^b each act as an active elec-

trode, thus forming a plurality of ionization zones through which the stream passes while traversing the apparatus. Hence, the stream is subjected to maximum ionization

5 action and the particles or molecules will be carried on to the collecting electrodes 10 and 11 in the usual manner. However, the collecting faces of the cylinders are rotatable so that during rotation the active portions 10 of the surfaces will pass from the active portions of the field into the inactive portion formed by the gap in the active electrode and in which the strain lines are absent or materially less effective. The deposit-removing device is reached and the 15 relative movement between collecting surfaces and the device causes the deposits to be removed, the surfaces again entering the active field portion and receiving new deposits. 20

As will be understood, the active portion of the field remains constant although the collecting surfaces are shifted between the active and inactive portions of the field. 25 Hence the stream flow may be constant with the rate based on the capacity of the field to remove the deposits under normal operation, the deposit-removal problem being practically eliminated. In addition, the potential may be maintained close to the critical break-down voltage, thus increasing the efficiency and incidentally permitting increase in rate of stream flow, it being understood that the speed of rotation of the collecting electrodes may be controlled so as to 35 practically insure that the amount of deposits will not reach a depth sufficient to cause the disruptive discharge action excepting possibly under abnormal conditions. 40 And in meeting these conditions the fact that the surface is constantly changing position within the active portion of the field, and the presence of a plurality of ionization zones through which the stream passes, tends to prevent formation of built-up deposits of large magnitude at isolated points. 45

The scraper may be in actual contact with the collecting surfaces, thus cleaning them more or less thoroughly. However, this is 50 not essential since a slight spacing will be effective, the presence of a small deposit on the surfaces reëntering the active portion of the field offering no material objection.

While I have shown but one field structure, it will be readily understood that by 55 the addition of another cylinder concentric with those shown together with an additional active electrode within the space thus formed, an additional field may be provided, the cylinder being mounted on the turn-table and the active electrode connected in the active electrode system. And such 60 additions may be duplicated as desired, thus meeting the problem of capacity, since each additional field increases the amount of

gas, etc., which may pass the structure. It will be understood of course, that each field would have its individual removal device.

It will be obvious that the apparatus will operate with current of any of the well-known types, as for instance, pulsating, oscillating, or the continuous current type, the question of the more or less adherence of deposits being practically eliminated. 70

While I have shown the gap of the active electrode as extending in a vertical plane, it will be understood that this may be varied to meet operating conditions, the deposit-removal device being arranged accordingly. For instance, it may be arranged more or less inclined to the vertical, in which case a baffle may project from the rear of the scraper to direct the adjacent portion of the stream into an active portion of the field. 80

The terms fluid used herein is intended to include streams of either liquid or gaseous contents or a combination of both, as distinguished from streams of substantially solid matter, such, for instance, as solid streams of powdered material. 85

While I have herein shown and described one embodiment for carrying out the general principles of my invention, it will be readily understood that the exigencies of installation and use and the character of work to be performed may require various changes and modifications in the construction and arrangement of parts, and I desire to be understood as reserving the right to make any and all such changes or modifications as may 100 be required or deemed desirable in so far as the same may fall within the spirit and scope of the broad invention disclosed, as expressed in the accompanying claims.

Having thus described my invention, what I claim as new is: 105

1. In the art of electrical precipitation from flowing fluid streams and in which deposits are collected on a stream boundary, the method of removing such deposits which consists in establishing a permanently inactive zone in the electric field, shifting the deposit-laden boundary to such zone, and removing the deposits from the boundary while the latter is within the zone. 115

2. In the art of electrical precipitation from flowing fluid streams and in which deposits are collected on a stream boundary, the method of removing such deposits which consists in establishing a permanently inactive zone in the electric field, moving the deposit-laden boundary laterally of the direction of stream flow into such zone, and removing the deposits from the boundary while the latter is within the zone. 120

3. The method of collecting and removing particles or molecules from a flowing fluid stream, which consists in establishing an electric field with permanently located active and inactive portions to collect the 125 130

deposit material on a stream boundary within an active portion of the field, shifting the deposit-laden boundary between the active and inactive field portions, and removing the deposits from the boundary while in the inactive portion.

4. In the art of electrical precipitation from fluid streams, opposing electrode systems adapted to produce an electric field having permanently-located active and inactive portions, means for moving the systems relatively to each other to bring a deposit-collecting face into an inactive portion of the field, and means for removing deposits while in such inactive portion.

5. In the art of electrical precipitation from fluid streams, opposing electrode systems adapted to produce an electric field having permanently-located active and inactive portions, means for moving the collecting electrode system between the active and inactive portions, and means for removing the deposits while in the inactive portion.

6. In the art of electrical precipitation from fluid streams, opposing electrode sys-

tems adapted to produce an electric field having permanently-located active and inactive portions, means for rotating the collecting electrode system on its axis to shift a deposit-collecting face between such field portions, and means active within such inactive portion for removing the deposits from the face.

7. In the art of electrical precipitation from fluid streams, a rotatable tubular collecting electrode, an active electrode extending concentrically and formed to produce permanently-located active and inactive portions of an electric field on a cross-section on the collecting electrode, and means within the inactive portion of the field and rendered active by electrode rotation for removing the deposits within such inactive portion.

In testimony whereof I have affixed my signature in the presence of two witnesses.

CHARLES W. GIRVIN.

Witnesses:

V. G. SCOTT,

FRANCIS D. MAHONE.

It is hereby certified that in Letters Patent No. 1,252,104, granted January 1, 1918, upon the application of Charles W. Girvin, of Philadelphia, Pennsylvania, for an improvement in "The Art of Electrical Precipitation of Particles from Fluid Streams," an error appears in the printed specification requiring correction as follows: Page 4, line 40, claim 7, for the word "on" read *of*; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 12th day of February, A. D., 1918.

[SEAL.]

J. T. NEWTON, ·

Commissioner of Patents.

Cl. 183—7.