

L. BRADLEY.

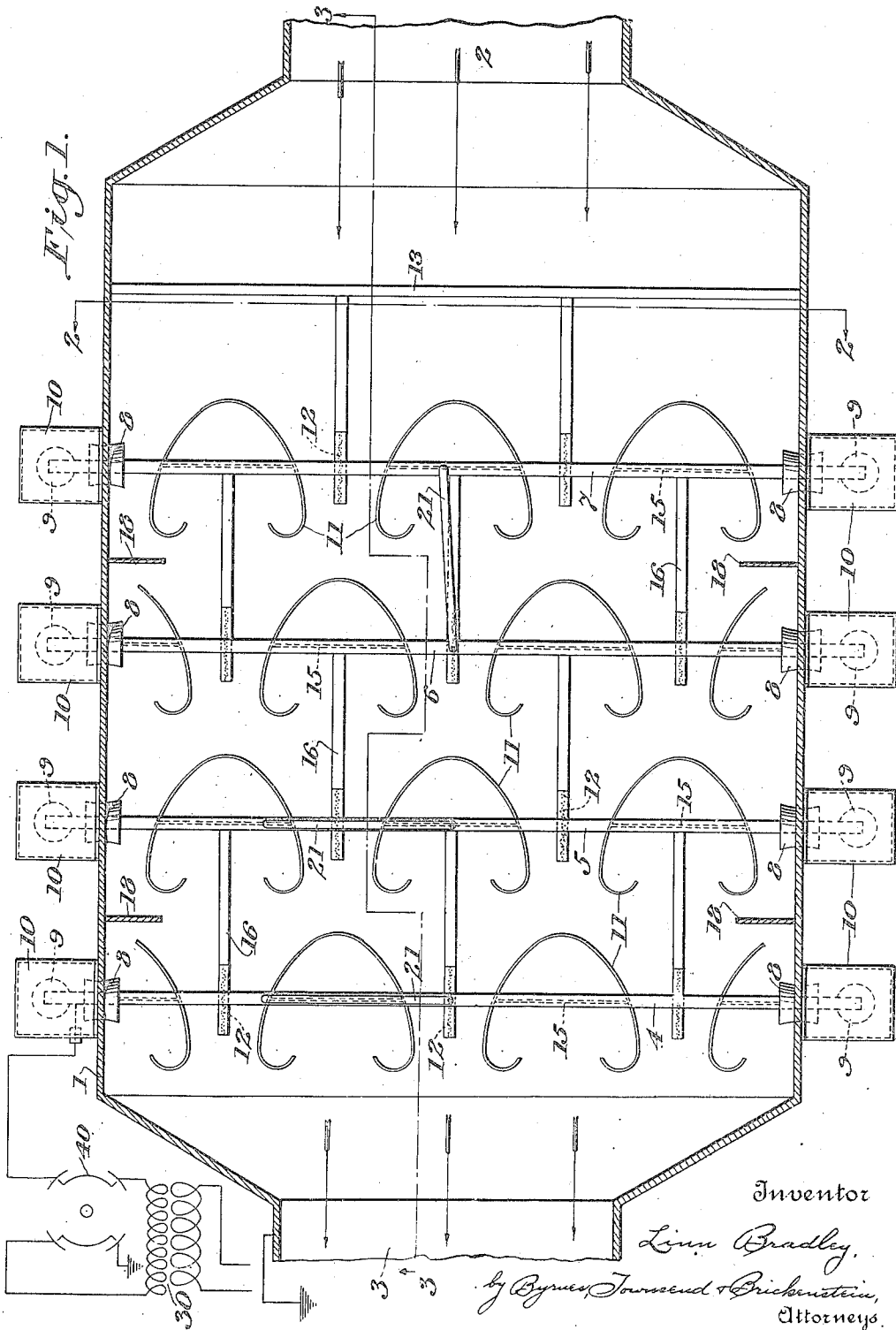
APPARATUS FOR THE ELECTRICAL TREATMENT OF GASES.

APPLICATION FILED JUNE 26, 1918.

1,400,795.

Patented Dec. 20, 1921.

5 SHEETS—SHEET 1.



L. BRADLEY.

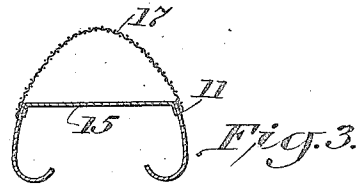
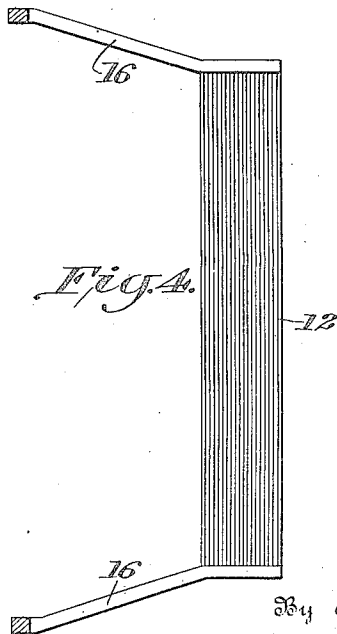
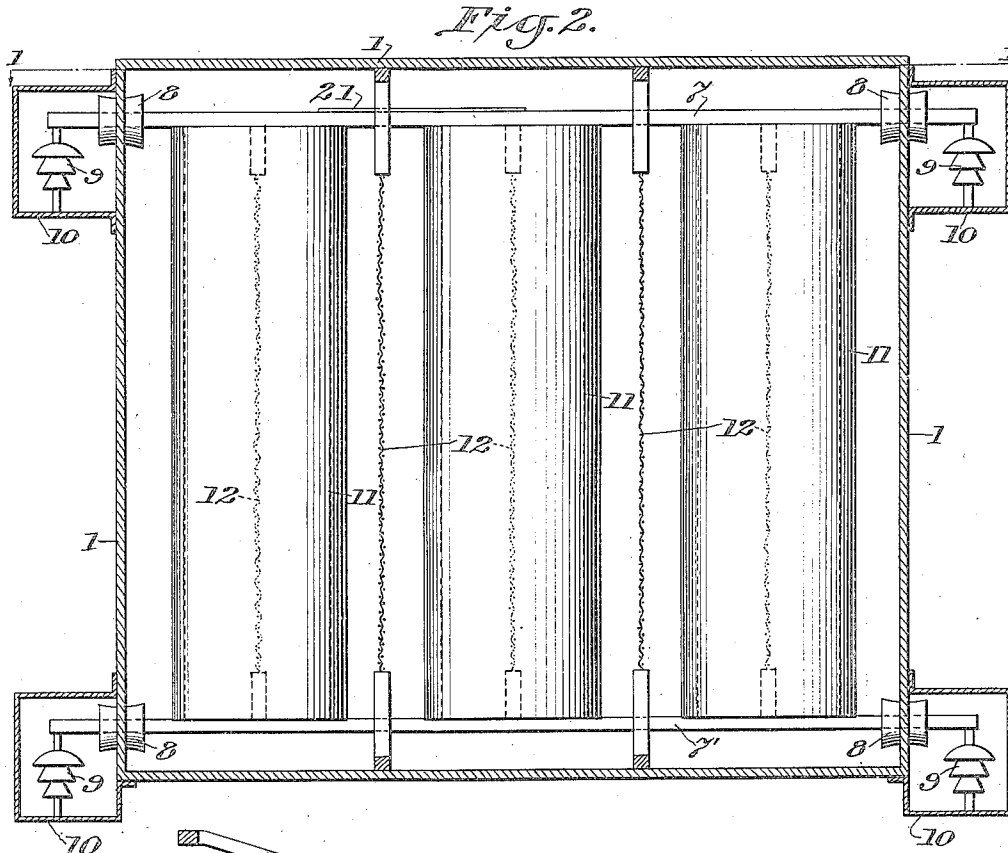
APPARATUS FOR THE ELECTRICAL TREATMENT OF GASES.

APPLICATION FILED JUNE 26, 1918.

1,400,795.

Patented Dec. 20, 1921.

5 SHEETS—SHEET 2.



Inventor
Linn Bradley,

By Byrnes Townsend & Brickmaster,
Attorneys.

L. BRADLEY.

APPARATUS FOR THE ELECTRICAL TREATMENT OF GASES.

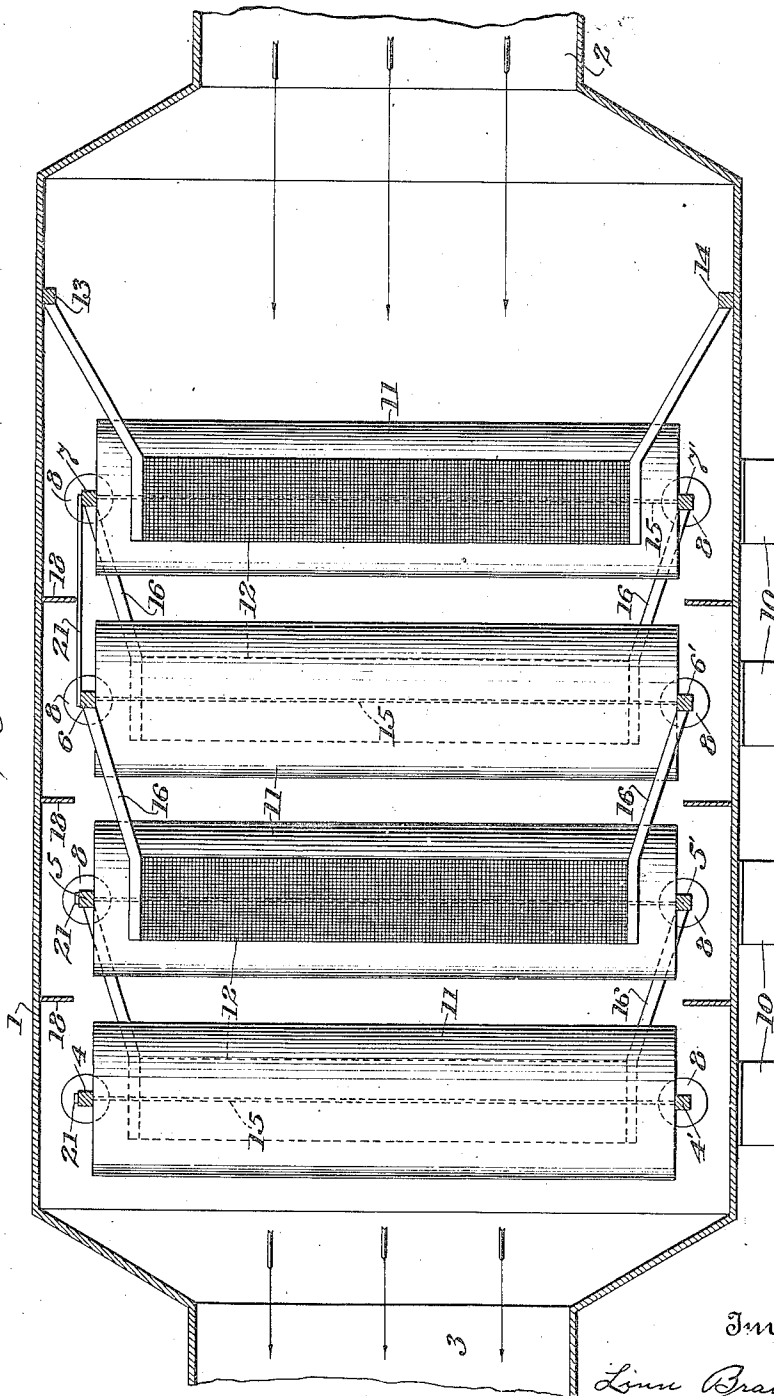
APPLICATION FILED JUNE 26, 1918.

1,400,795.

Patented Dec. 20, 1921.

5 SHEETS—SHEET 3.

Fig. 5.



Inventor

Linn Bradley,

By *Byrnes, Townsend & Brickerstein,*
Attorneys

L. BRADLEY.

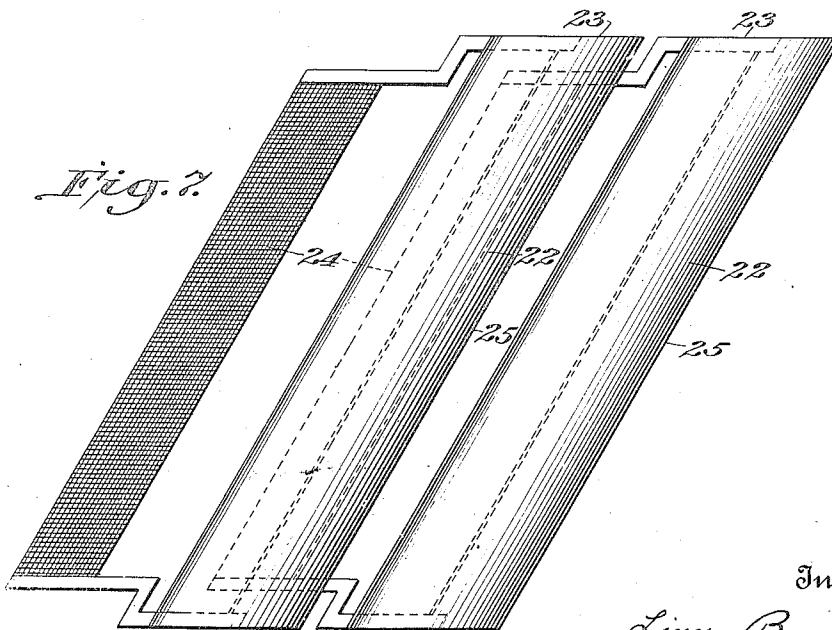
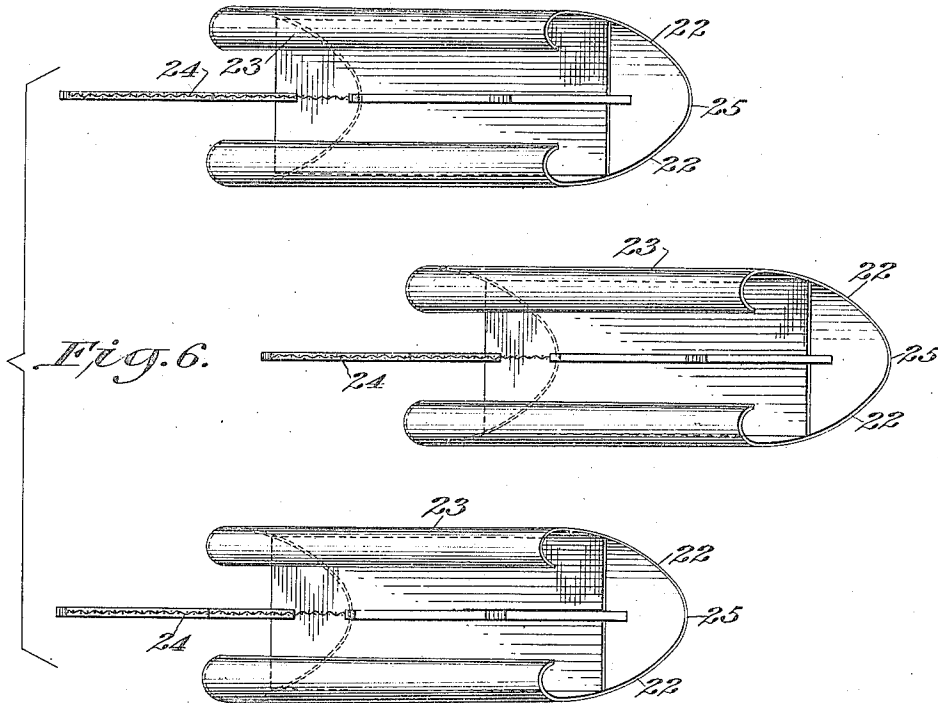
APPARATUS FOR THE ELECTRICAL TREATMENT OF GASES.

APPLICATION FILED JUNE 26, 1918.

1,400,795.

Patented Dec. 20, 1921.

5 SHEETS—SHEET 4.



Inventor

Linn Bradley,

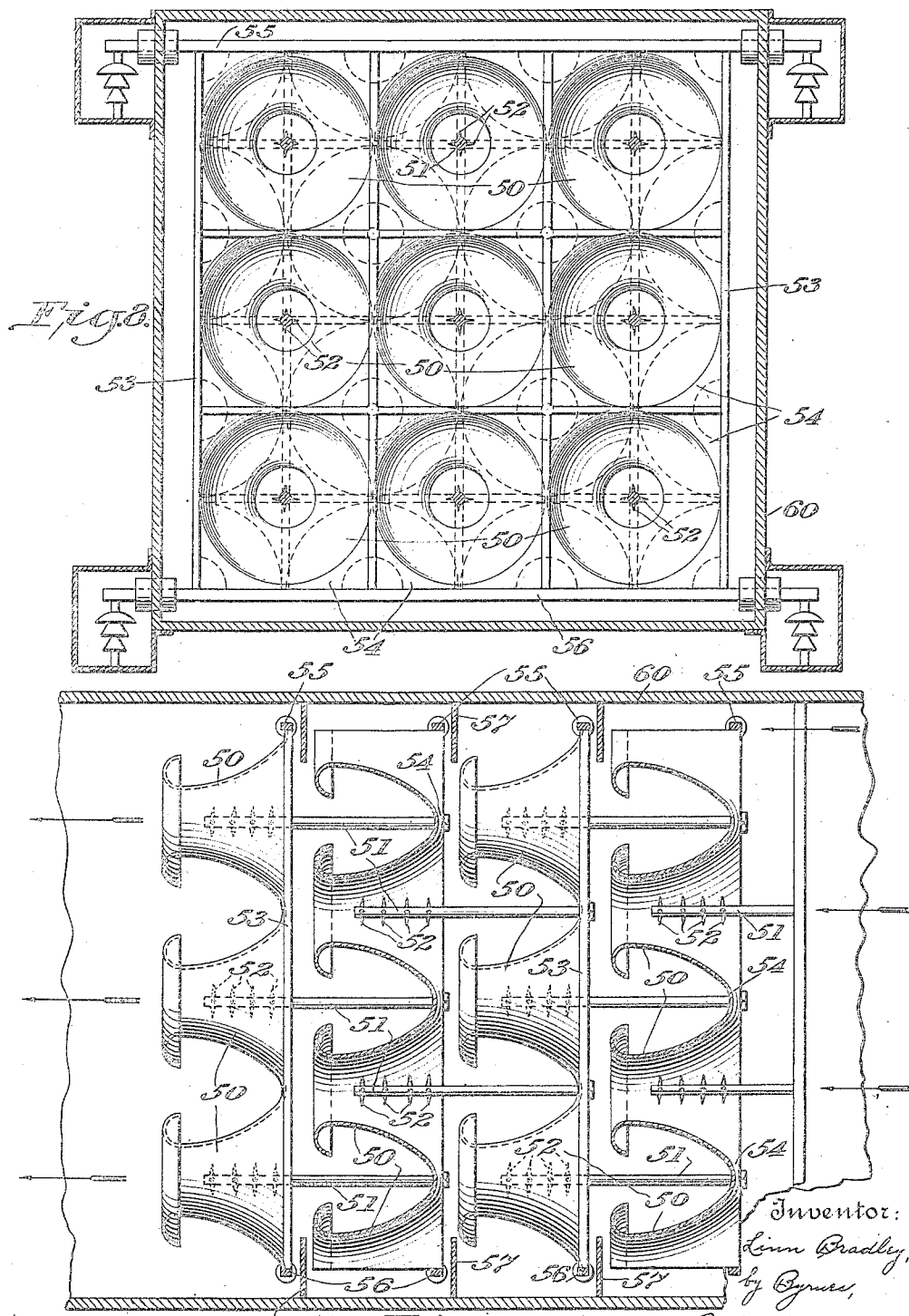
By Byrnes, Townsend & Brickenstein,

Attorneys.

L. BRADLEY.
APPARATUS FOR THE ELECTRICAL TREATMENT OF GASES.
APPLICATION FILED JUNE 26, 1918.

1,400,795.

Patented Dec. 20, 1921.
5 SHEETS—SHEET 5.



Inventor:
Linn Bradley,
by Byrnes,
Fig. 9. Townsend & Bickelstein, Attorneys.

UNITED STATES PATENT OFFICE.

LINN BRADLEY, OF EAST ORANGE, NEW JERSEY.

APPARATUS FOR THE ELECTRICAL TREATMENT OF GASES.

1,400,795.

Specification of Letters Patent.

Patented Dec. 20, 1921.

Application filed June 26, 1918. Serial No. 242,046.

To all whom it may concern:

Be it known that I, LINN BRADLEY, a citizen of the United States, residing at East Orange, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Apparatus for the Electrical Treatment of Gases, of which the following is a specification.

This invention relates to apparatus for the electrical treatment of gases or gaseous mixtures.

The object of the present invention is to provide an electrical apparatus of the class referred to which may be adapted, by simple manipulation, to various conditions arising during its operation.

Another object is to provide a treater which may be regulated to maintain a high-all-round efficiency.

The characteristic feature of the invention is the connection in series of a plurality of like treater units by electrostatic induction. The specific construction will be more clearly defined in the specification and more particularly pointed out in the claims.

In the drawings which form a part of the specification,

Figure 1 is a horizontal section along line 1—1, Fig. 2 of a device embodying the invention;

Fig. 2 is a vertical section on line 2—2, Fig. 1;

Fig. 3 is a horizontal section through a collecting electrode;

Fig. 4 an elevation of a discharge electrode;

Fig. 5 is a vertical section on line 3—3, Fig. 1;

Figs. 6 and 7 are a plan view and a side elevation respectively of a modification, and

Figs. 8 and 9 are a vertical and horizontal section respectively through another form of the invention.

1 is the casing or housing for the treater elements. The gas to be treated is admitted through the inlet 2 and the cleaned gas passes out through an outlet 3. As indicated in Figs. 1, 2, 5, 8 and 9 there are four groups of units connected in series, each group comprising a plurality of units in parallelism.

4, 5, 6 and 7 are cross-bars extending near the top of the casing 1 through the side walls thereof and 4', 5', 6' and 7' are similar cross-bars extending through the lower part of the casing. These bars, which are of electrical conducting material, are insulated

from each other and from the walls of the casing by suitable bushing insulators 8 and are supported outside the casing by suitable insulators 9 of the post type. In order to prevent the flow of gas to the outside through the bushing insulators 8, a suitable housing 10 may be provided which may serve at the same time as a support for the insulators 9.

Between the bars 4 and 4', 5 and 5', 6 and 6', 7 and 7' are mounted the collecting electrodes 11 which may have any desired form, the particular form shown being preferred, however, for reasons to be subsequently pointed out. Discharge electrodes 12 extend into the space between the collecting electrodes and are spaced from the bars 4, 4', 5, 5' etc. a distance sufficient to prevent spark over. The discharge electrodes of one group are electrically connected to the collecting electrodes of the group next following.

One mechanical arrangement by which the electrodes may be operatively associated is indicated in the drawings. The collecting electrodes 11 are attached to webs 15 which are in turn connected to and supported by the cross-bars 4, 4' etc. The discharge electrodes 12, which may consist of a plurality of straight wires or of wire screen or have any other form of such character as to facilitate corona discharge, are held between cantalivers 16 which are in turn attached to the bars 5, 5', etc., of the collecting electrodes of the group next following, and so on.

The discharge electrodes 12 of the last group are electrically connected to the casing 1 through the cross-bars 13 and 14 by which they are supported. The charging current may be derived, as usual, from the secondary of a step-up transformer 30 and a rectifier 40 or from a high-tension D. C. generator, one pole being connected to the bar 4 or bar 4' and the other through ground to the bars 13 and 14.

As indicated in Fig. 3, the portion 17 of the collecting electrodes may consist of screen or perforated material.

Suitable baffle plates 18 of asbestos or other like material may be attached to the top, bottom and side walls of the treater to force the gas to pass through the spaces defined by the adjacent electrodes.

The walls of the treater may be advantageously made of insulating material. In such case the collecting electrodes may be brought substantially in contact with the

floor, ceiling and walls of the treater chamber and the baffles 18 may be omitted.

The operation of the apparatus is as follows:

- 5 One pole of the source of current being connected to the bars 4, 4' and the other to the bars 13, 14 through ground, the four groups of electrodes are electrostatically connected in series across the line potential and
10 since the groups and the elements of each group are substantially identical, the potential difference is proportionately divided. The dielectric stress existing between each discharge electrode and the adjacent collecting electrodes is therefore substantially the same.

- As the gas is forced to pass successively through the passages defined by the collecting electrodes of each group, it is subjected to the
20 action of the electric fields. Since the character of the surfaces of the electrodes is such that there is a great preponderance of ionization from the discharge electrodes to the collecting electrodes the particles suspended in the gas are charged by the ions emanating from the discharge electrodes and under the influence of these charges migrate toward the collecting electrodes to which they have a tendency to attach themselves.

- The collecting electrodes 11 are preferably shaped and positioned to present relatively inclined surfaces toward each other so as to form a gradually contracted passage for the
35 gas. The gases are subjected to repeated changes in velocity and due to the resulting centrifugal effect a certain amount of mechanical separating is effected. Because of the fact that the velocity of the gas and the intensity of the electric field vary in the same proportion it is possible to maintain a higher operating voltage and consequently a more intense ionization. Immediately after being subjected to this intense ionization the
40 gas passes into a region of comparative quiet where conditions are favorable for deposition of the precipitate. Due to the increased velocity at the most constricted portion of the gas passage there is little opportunity for the precipitate to build up on the collecting electrode at this point.

- The nose portion 17 of adjoining collecting electrodes may be formed of screen or perforated metal. The use of such a screen
55 portion would allow the utilization of the space inclosed between the nose portion 17 and the web 15 as a dead air pocket where particles driven through the screen portion could settle without interference.

- This type of precipitator offers distinct advantages in the way of flexibility of operation. It may be accommodated to any voltage by simply increasing or decreasing the number of groups in the series, or to
65 any volume by increasing the number of

units in each group of the series. The whole apparatus may be made up of units having a single standard form.

If the velocity and volume of gas remain constant and the impressed voltage is unchanged, electrical break down between any two groups of the series will result in increased field intensities at the remaining members of the series. This characteristic affords an automatic means of regulating the operation of precipitation, because the elimination of one treater group is compensated for by the increased field intensity at the remaining groups.

By a suitable switching arrangement it is possible to add or subtract groups without in any way changing conditions that affect gas distribution in the treater. As for instance indicated in Figs. 1, 2 and 5, a knife switch 21 may be pivotally mounted on each bar 4, 5, etc. Ordinarily the switch 21 may be turned into alinement with the bar on which it is mounted. If it is intended to cut out a group of treater elements, it is merely necessary to swing the knife switch 21 of that group into contact with the cross-bar of the group next following.

By providing a suitable number of groups it is thus not only possible to replace a disabled group by another group, but it is also possible to vary the time of treatment of the gas, the power per cu. ft. of gas, the field intensity, and the total capacity of the treater without disturbing the gas flow. A greater range of operating conditions would be obtained by using two or three sets with separate electrical equipment.

In a single treater of the kind described the treatment of the gas may be successively altered to suit the changed condition of the gas as it passes through the various parts of the treater. Thus it would be possible, for instance, to decrease the electrode spacing as the conductivity of the gas decreased due to the removal of a part of the suspended particles. It is therefore possible to vary the treatment in a single treater.

Figs. 6 and 7 show a modification of the device disclosed in Figs. 1-5. The electrodes are slanted to include with the horizontal an angle of about 60°. The advantage of this arrangement is due to the fact that the surface 22 of the collecting electrodes 23 is slanted and is located in a region of comparative quiet. Any dust settling on this surface will slide down it with little interference from the gas current. Also the accumulation of dust on this surface will in no way reduce the air gap between the collecting electrodes 23 and the discharge electrodes 24. With the electrodes slanted as shown there would of course be little advantages in making the nose portion 25 of screen as suggested with reference to the portion 17 in Fig. 3.

The form of the invention illustrated in Figs. 8 and 9 is generally the same as that shown in Figs. 1, 2 and 5, but differs therefrom as to the form of the electrodes. The

5 collecting electrodes 50 are tubular elements which are preferably tapered to form gradually constricted passage ways for the gas and the discharge electrodes 51 are relatively slender rods studded with prongs 52
10 to facilitate discharge. The collecting electrodes 50 are supported on frames 53 of angle iron or other suitable material secured to the bars 55, 56 and the interstices 54 between the tubes may be closed up by sheet
15 material to force all the gas to pass through the tubes. The rods 51 forming the discharge electrodes for one group of collecting electrodes are secured to the frame 53 of the preceding group. The disposition
20 of the electrodes is preferably so made that the axes of the tubes 50 of one group pass centrally through the spaces defined by the axes of the tubes of the groups immediately preceding and following as clearly indicated.
25 Baffles or barriers 57 may be provided along the walls of the treater chamber 60 to prevent the gas from passing through the space between the walls and the barrier formed by frames 53.

30 It is understood that various changes and modifications may be resorted to within the scope of the above disclosure which is only for the purpose of illustration.

The device may be operated by A. C. as well as by D. C. While the forms of devices illustrated are constructed as horizontal
35 treaters *i. e.* as treaters in which the gases are passed through the treater chamber in horizontal direction, it is obvious that they may
40 be constructed as vertical treaters.

I claim:

1. Apparatus for the electrical separation of suspended particles from gases comprising a plurality of treater units connected in
45 series by electrostatic induction.

2. In apparatus for the electrical separation of suspended particles from gases, a treater chamber containing a plurality of treater units connected in series by electro-
50 static induction.

3. Apparatus for the electrical separation of suspended particles from gases comprising a plurality of treater units connected in series by electrostatic induction to form a
55 continuous passage-way for the gas.

4. Apparatus for the electrical separation of suspended particles from gases comprising a plurality of groups of parallel treater units connected in series by electrostatic in-
60 duction.

5. In apparatus for the electrical separation of suspended particles from gases, a treater chamber containing a plurality of groups of parallel treater units connected
65 in series by electrostatic induction.

6. Apparatus for the electrical separation of suspended particles from gases comprising a plurality of groups of parallel treater units connected in series by electrostatic induction to form a continuous passage-way 70 for the gas.

7. In apparatus for the electrical separation of suspended particles from gases, a plurality of discharge electrodes, a plurality of collecting electrodes and a plurality of 75 elements inductively connected therebetween, said elements comprising each as integral electrical parts a collecting electrode and a discharge electrode for coöperation with said discharge electrodes and said col- 80 lecting electrodes respectively.

8. In apparatus for the electrical separation of suspended particles from gases, a plurality of discharge electrodes, a plurality of collecting electrodes and a plurality of 85 elements inductively connected therebetween, said elements comprising each as integral electrical parts, a collecting electrode defining passage ways for the gas and a discharge electrode for coöperation with said 90 discharge electrodes and said collecting electrodes respectively.

9. Apparatus for the electrical separation of suspended particles from gases comprising a plurality of treater units connected in 95 series by electrostatic induction and means for making any unit of the series ineffective at will.

10. In apparatus for the electrical separation of suspended particles from gases a 100 collecting electrode element having relatively long and separate surfaces transversely inclined toward each other to form a gradually contracted passage-way for the gases and a discharge electrode substantially 105 co-extensive with the collecting electrode in the said passage-way.

11. In apparatus for the electrical separation of suspended particles from gases, a collecting electrode element having relatively 110 long and separate surfaces transversely inclined toward each other to form a gradually contracted passage-way for the gases and inclined relatively to the gas stream and a discharge electrode extending into the said 115 passage-way.

12. Apparatus for the electrical separation of suspended particles from gases comprising a treater chamber, inlet and outlet means for passing the gases therethrough in 120 horizontal direction, separate collecting surfaces defining a passage-way for the gases and contracted in the direction of the gas flow, said surfaces being inclined to allow the precipitate to slide down over the col- 125 lecting surface.

13. Apparatus for the electrical separation of suspended particles from gases comprising a treater chamber, inlet and outlet means for passing the gases therethrough in 130

horizontal direction, a collecting electrode having relatively long and separate surfaces transversely inclined toward each other to form a gradually contracted passage-way for the gases, said electrode being inclined 5 relatively to the gas stream to allow the precipitate to slide down over the surfaces.

14. Apparatus for the electric separation of suspended particles from gases, comprising a chamber, a plurality of collecting 10 electrodes in series in the path of the gas stream, the said electrodes forming gradually contracted passage ways for the gases and discharge electrodes extending into said 15 passage ways.

15. Apparatus for the electric separation of suspended particles from gases, comprising a plurality of treater units connected in series by electrostatic induction to form a continuous passage way for the gas, the 20 collecting electrodes of said units forming gradually contracted passageways for the gas.

In testimony whereof I affix my signature in presence of two witnesses.

LINN BRADLEY.

Witnesses:

A. F. MESTON,
J. HUFF.