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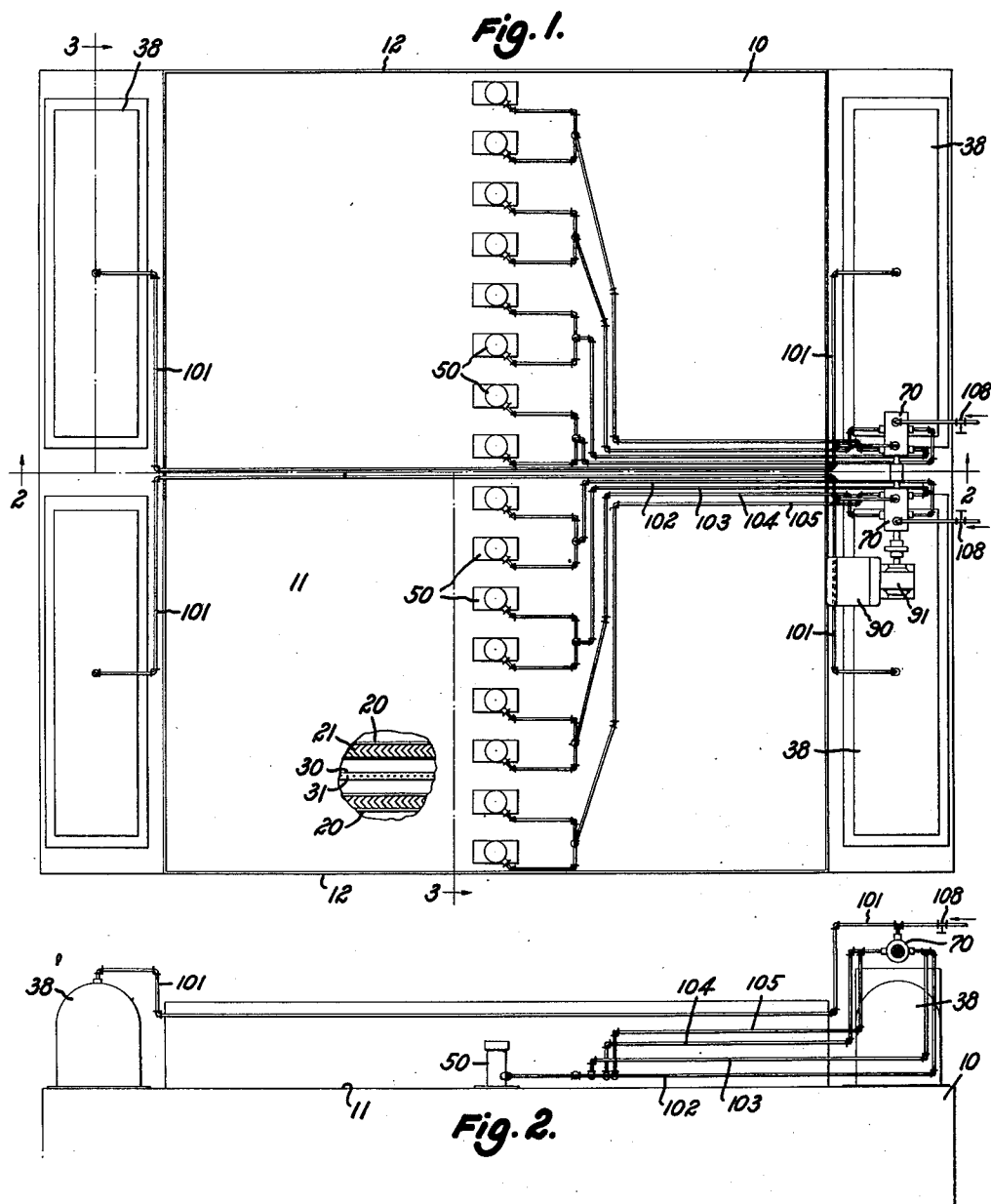
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2,392,088

RAPPING DEVICE

Filed July 30, 1943

4 Sheets-Sheet 1



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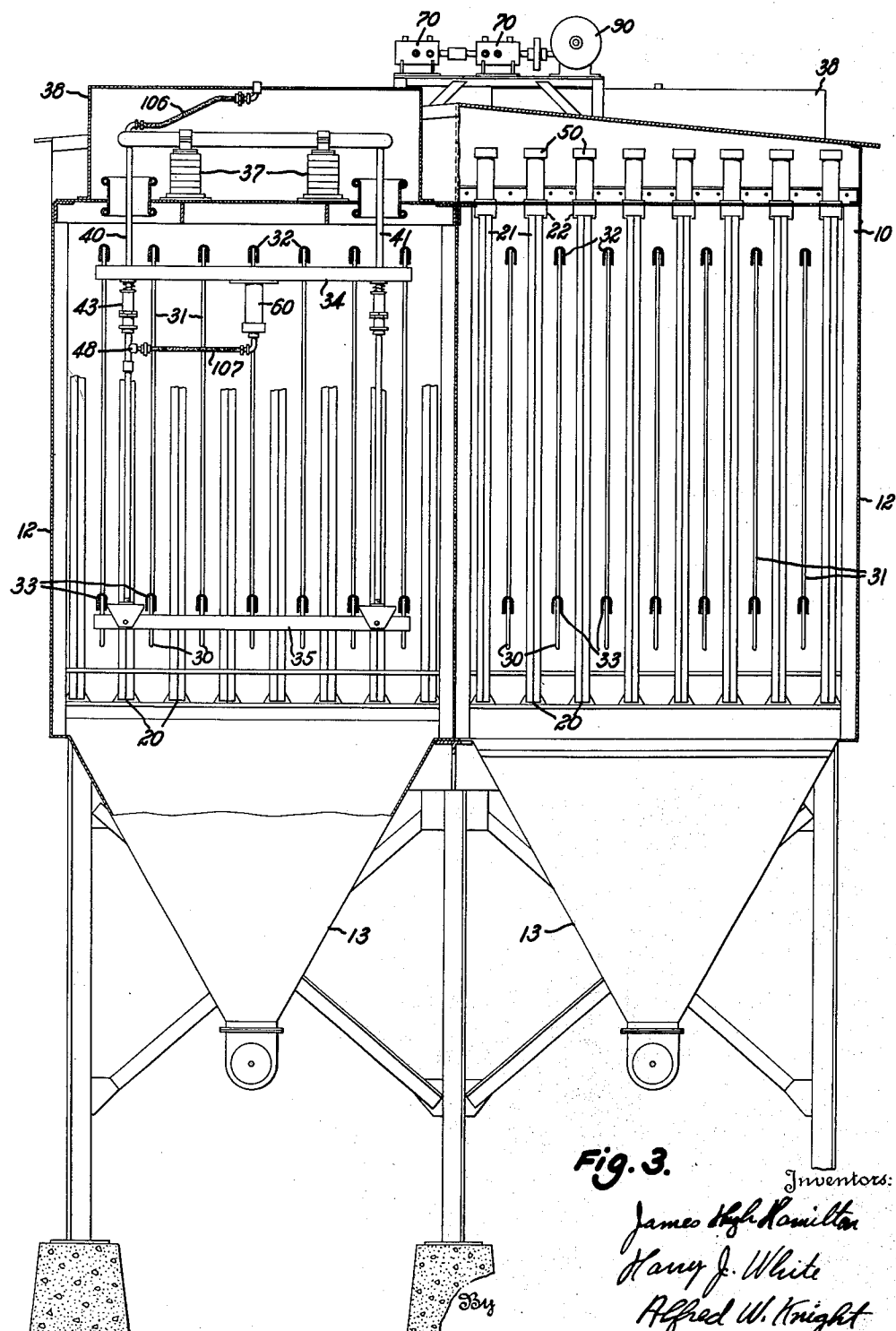
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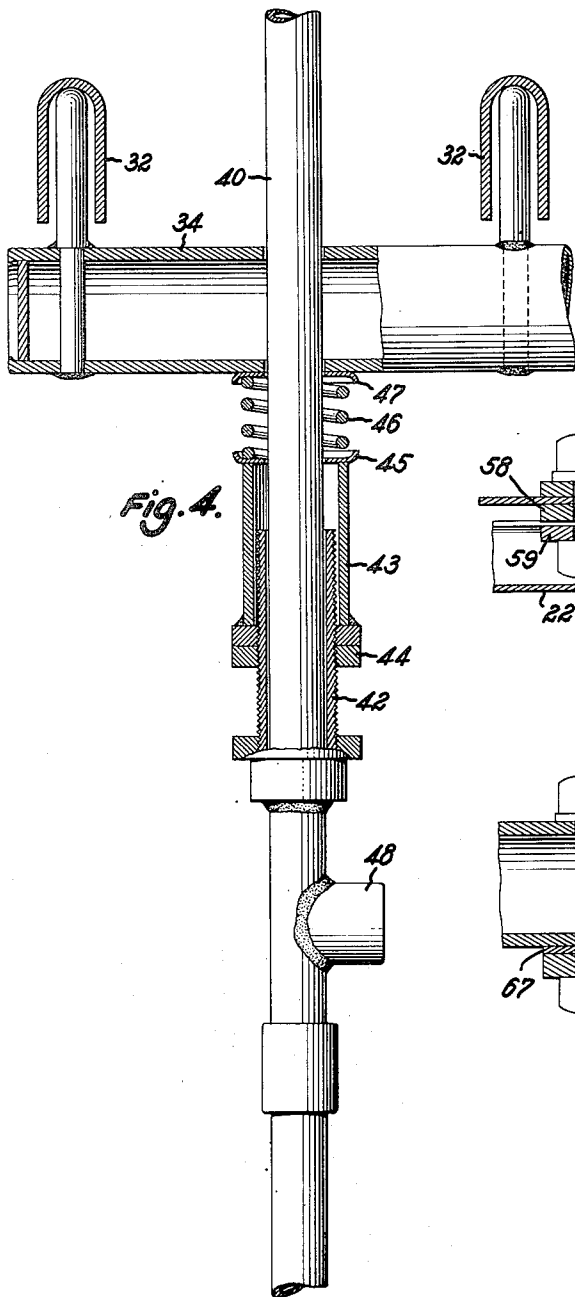


Fig. 4.

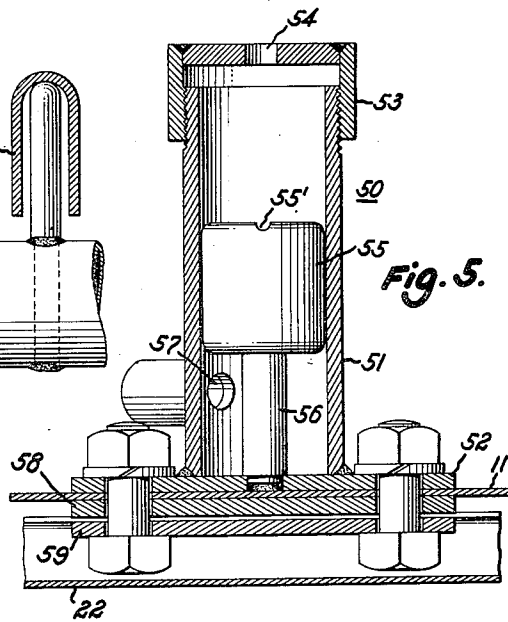


Fig. 5.

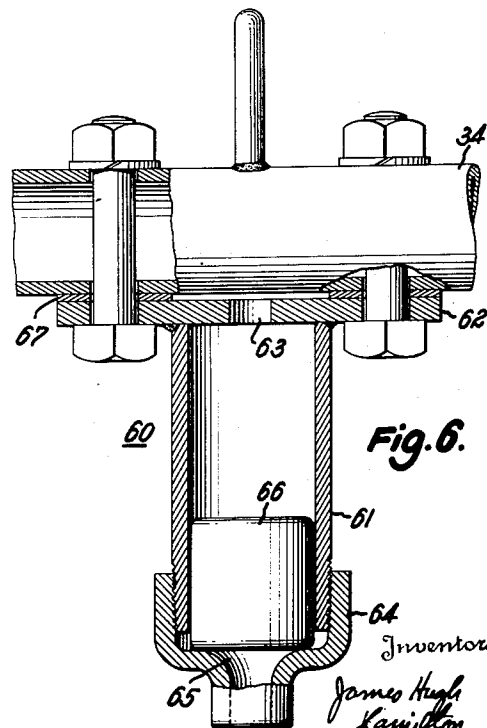


Fig. 6.

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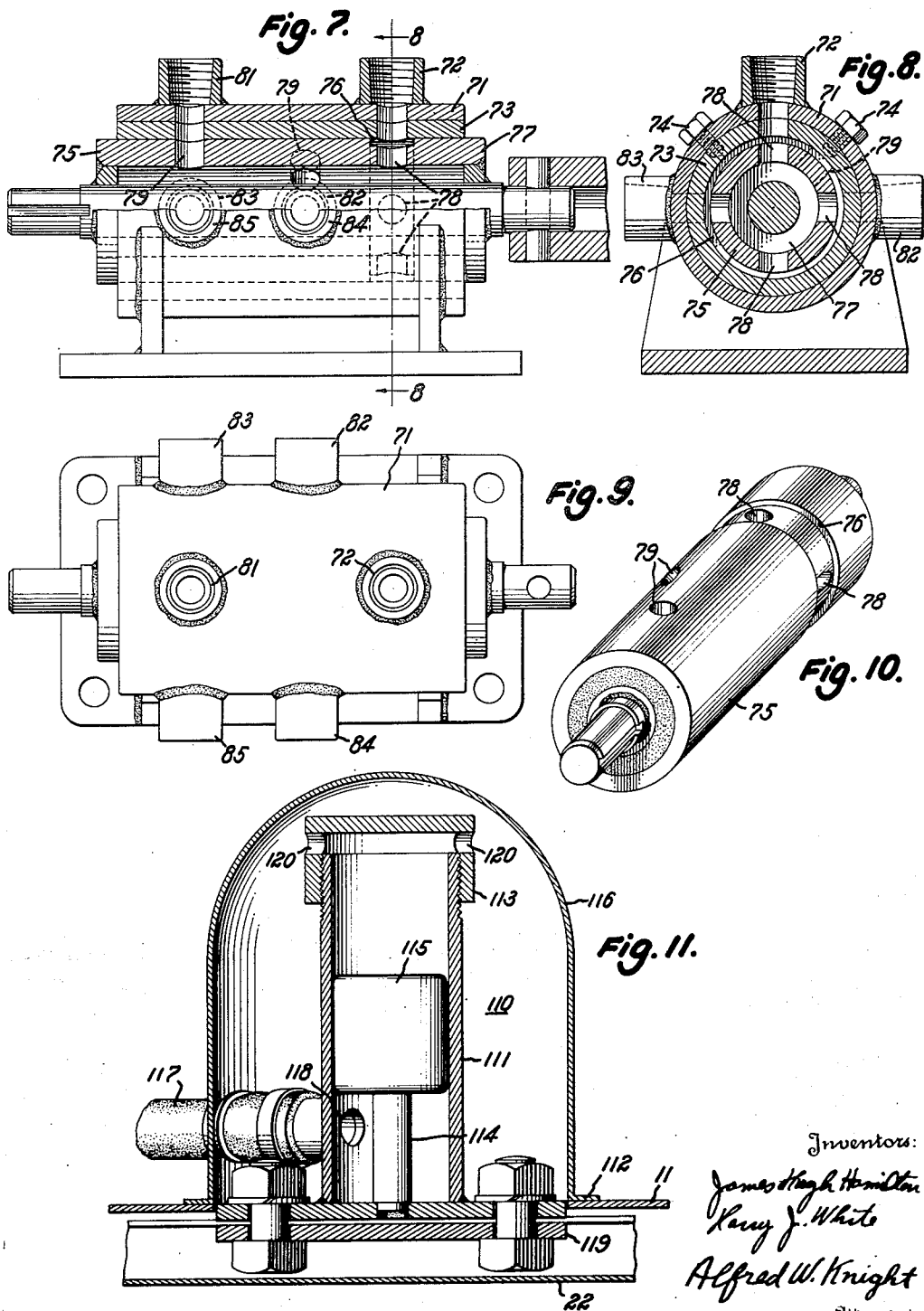
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4 Sheets-Sheet 4



UNITED STATES PATENT OFFICE

2,392,088

RAPPING DEVICE

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Application July 30, 1943, Serial No. 496,808

5 Claims. (Cl. 183-7)

This invention relates to apparatus for rapping the material collecting members of gas cleaning devices and particularly to apparatus for rapping the electrodes of electrical precipitators.

A principal object of the invention is the provision of an efficient and effective rapping device.

Another object of the invention is the provision of a simple, fluid-pressure actuated rapper with a minimum of moving parts.

A further object of the invention is the provision of a system for insuring the regular, uniform and automatic rapping of the electrodes of electrical precipitators.

The invention comprises a fluid-pressure actuated rapper including a cylinder, a free piston in the cylinder and means for intermittently supplying a fluid pressure medium, such as compressed air, to the cylinder to bring about an impact of the piston against a striking surface at one or both ends of the piston.

The invention also comprises means for supplying a fluid pressure medium, such as compressed air, to a plurality of rapping devices in predetermined amounts and at predetermined intervals, typically including a rotary multiple port valve device for controlling the flow of compressed air from a single source to a plurality of rapping devices.

For the purpose of illustration the invention will be further described with reference to the accompanying drawings showing a rapping device and system embodying the principles of the invention applied to an electrical precipitator.

In the drawings:

Fig. 1 is a diagrammatic plan view with parts broken away of the top of an electrical precipitator including the rapping system of the invention;

Fig. 2 is a side elevation of the rapping system of Fig. 1 in partial section along line 2-2 of Fig. 1;

Fig. 3 is a transverse sectional elevation on line 3-3 of Fig. 1;

Fig. 4 is a fragmentary enlarged view of a portion of the high tension electrode frame assembly of the precipitator;

Fig. 5 is a sectional elevation of a rapping device of the invention particularly adapted to the rapping of the collecting electrode assemblies of the precipitator;

Fig. 6 is a sectional elevation of a rapping device of the invention particularly adapted to the rapping of the high tension or precipitating electrode assemblies of the precipitator.

Fig. 7 is a side elevation in partial section of the rotary control valve of the invention;

Fig. 8 is a transverse section on line 8-8 of Fig. 7;

Fig. 9 is a plan view of the control valve;

Fig. 10 is a perspective view of the plug member of the control valve, and

Fig. 11 is a modified form of the rapping device of the invention adapted for rapping collecting electrode assemblies.

The electrical precipitator to which the rapping device of the invention is applied for the purposes of the invention comprises, as shown more particularly in Figs. 1 and 3 of the drawings, a shell 10, providing a passage for the horizontal flow of gas therethrough and including a roof 11, sides 12 and material collecting hoppers 13.

Mounted within the shell 10 are a plurality of vertical, longitudinally-extending collecting electrode assemblies 20 and complementary precipitating electrode assemblies.

The collecting electrode assemblies comprise a plurality of V-shaped elements 21 mounted in suitable supporting framework and carried at their upper ends in channel members 22 which rest loosely at each end on transverse support members attached to shell 10, as shown for example in application Serial No. 450,711, filed July 13, 1942, of Harry J. White, now Patent 2,369,877, dated Feb. 20, 1945.

The precipitating electrode assemblies 30 comprise a plurality of wire or rod elements 31 attached to horizontal top members 32 and bottom members 33 which rest on transverse top members 34 and bottom members 35, respectively, of the high tension electrode frame. This frame is carried by means of lateral vertical supports 40, 41 from transverse bus bars 36 mounted on insulators 37 in insulator housings 38 at each end of the shell.

To provide a resilient support for the high tension electrode assemblies which is structurally firm but will not transmit an undue amount of vibration to the insulator supports, the horizontal frame members 34 are spring mounted on the vertical supporting members 40, 41, as shown in detail in Fig. 4 of the drawings. Externally threaded sleeve 42 is fastened to the outside of the frame member 40 (or 41) and adjustable sleeve 43 is threaded thereto and held in position by means of lock nut 44. Frame member 34 is supported on the upper end of adjustable sleeve 43 through washer 45, coil spring 46, and washer 47. The hollow tubular member 40 is provided with a

horizontal nipple 48 for supplying compressed air to the rapping device as described hereinafter.

In the particular form of precipitator shown by way of example in the drawings, the collecting electrode assemblies are arranged in two parallel groups each comprising eight parallel vertical collecting electrode assemblies 30 and the precipitating electrode assemblies are correspondingly grouped into two main assemblies each including seven vertical curtains of high tension electrode members 31 positioned in alternate vertical planes parallel to the collecting electrode assemblies. A collecting electrode rapper 50 is provided for each of the sixteen collecting electrode assemblies and a precipitating electrode rapper 50 is provided at each end of each of the two main precipitating electrode assemblies.

Collecting electrode rapping device 50, as shown in detail in Fig. 5 of the drawings, comprises a cylinder consisting of a cylindrical section 51 welded to a base plate 52 and closed at its upper end by cap 53 having a central exhaust port 54. Within the cylinder is a free piston 55 having a slight clearance with the cylinder walls and resting in the normal vertical position of the device on anvil 56 carried by base plate 52. Compressed air supply port 57 opens into the cylinder below the piston in its resting position.

The rapping device 50 is bolted to channel member 22 midway of its length by means of bolts passing through base plate 52, roof member 11, spacer plate 58, channel member 22, and backing plate 59.

On admission of a slug of compressed air of short duration into cylinder 51 through port 57 the piston 55 is raised from its seat and caused to strike cap 54 with a force determined by the pressure of the air and the size and clearances of the piston. The compressed air escapes from the cylinder through the clearance between the cylinder and the piston and out through exhaust port 54. Groove 55' in the piston prevents sealing off of the exhaust port at the top position of the piston. The piston then drops back on anvil 56 with a force determined by its weight and clearances.

The high tension electrode rapping device 60, shown in detail in Fig. 6 of the drawings, comprises a cylinder member 61, welded to a base plate 62 having an exhaust port 63 therein. The cylinder is closed at its lower end by cap 64 having an inlet port 65. Positioned in the cylinder is a free piston 66, which in the normal position of the device as shown rests on the cap 64. The rapping device is attached to transverse member 34 of the high tension electrode assembly by means of bolts passing through the base plate 62, spacer plate 67 and member 34.

The mode of operation of the device is similar to that described above for the collecting electrode rapping device 50, the force of the impact of the piston 66 against the base plate 62 and cap 64 being determined by the air pressure and the size and clearances of the piston.

The rapper actuating and control system of the invention comprises one or more multiple port rotary valves 70 preferably driven by an electric motor 80 through reduction gear 91, as shown in Fig. 1 of the drawings.

A typical form of the control valve is shown in detail in Figs. 7-10 of the drawings. It comprises a cylinder 71 having an inlet port 72 and a suitable number, in the embodiment shown—five—of outlet ports 81, 82, 83, 84, 85, spaced lengthwise of the cylinder from the inlet port. The cylinder

is lined with bearing liner 73 having apertures corresponding to the inlet and outlet ports of the cylinder and fixed in position by set screws 74.

Mounted for rotation in the cylinder is rotary plug 75 having an annular channel 76 positioned for continuous communication with the inlet port 72, a longitudinal channel 77, one or more radial channels 78 connecting annular channel 76 with longitudinal channel 77, and a plurality of radial channels 79 communicating with longitudinal channel 77 and positioned to communicate with outlet ports 81, 82, 83, 84 and 85 at successive radial positions of the rotating plug. It will be seen that if a source of compressed air is connected to inlet port 72 successive slugs of compressed air will be delivered intermittently through outlet ports 81, 82, 83, 84 and 85 in regular succession.

In the actuating and control system as shown in Figs. 1 and 2 of the drawings, the slugs of compressed air from outlet ports 81 of each of the valves 70 are delivered to the high tension electrode rappers 50 on one side of the precipitator through conduits 101, while the slugs of compressed air from outlet ports 82, 83, 84, 85 are delivered to adjacent pairs of collecting electrode rappers 50 through conduits 102, 103, 104, 105, respectively. The system operates effectively with compressed air at a pressure of 80 to 100 pounds per square inch and with a speed of rotation of the distributing valve of 20 to 30 revolutions per minute. Advantageously the distributing valve may be controlled by an automatic timing switch (not shown) which actuates the valve, for example, for periods of 10 to 15 seconds at intervals of 15 to 20 minutes. The automatic control also advantageously shuts off the main air valves 108 between cycles of operation.

Conduits 100 are connected to the upper ends of tubular high tension electrode support members 40 by rubber tubes 106 and nipples 48 of the tubular support members 40 are connected to the inlet ports 65 of rappers 60 by rubber tubes 107 (Fig. 3). Rubber tubes 106 serve to insulate the high tension electrode assemblies from the rapping control system.

It will be seen that the system of the invention provides a regular succession of rapping impacts of predetermined force directly applied at selected portions of the collecting and high tension electrodes of the assemblies.

By means of the construction shown in Fig. 11 of the drawings, the roof member 11 of the precipitator chamber may be eliminated from the impact transmission assembly of the collecting electrode rapper as shown in Fig. 5. In this modification the rapper device 110, comprising a cylinder 111, base plate 112, cap 113, anvil 114 and free piston 115, is positioned in an opening cut in the roof 11 of the precipitator and is enclosed by a housing 116 attached to the roof 11. A flexible conduit 117 passing through housing 116 supplies compressed air to the inlet port 118 of the rapper. The rapper is attached to collecting electrode support member 22 by means of bolts passing through base plate 112, member 22, and backing plate 119. In the form of rapper shown in Fig. 11, the cap 113 contains lateral outlet ports 120 instead of the central outlet port shown in Fig. 5. In the rappers shown in the drawings, release of air pressure below the pistons may be effected by means of vents provided in the lower part of the cylinder. When such vents are provided, the clearance between the piston and the cylinder may be reduced.

We claim:

1. In an electrical precipitator, an electrode assembly rapping device comprising a vertical cylinder rigidly mounted on a member of said electrode assembly, a free piston positioned within said cylinder and having a limited clearance with the walls thereof, means for admitting fluid pressure impulses into said cylinder below said piston in the at rest position thereof, and an outlet port in the upper end of said cylinder.

2. In an electrical precipitator including collecting electrode and precipitating electrode assemblies, a plurality of vertical cylinders rigidly attached to members of the electrode assemblies, each of said cylinders having a free piston positioned therein, fluid pressure inlet and outlet ports in said cylinder below and above said free piston, respectively, and means for supplying intermittent fluid pressure impulses in succession to the inlet ports of said cylinders.

3. In an electrical precipitator including collecting electrode and precipitating electrode assemblies, a vertical cylinder rigidly attached to an electrode support member, a free piston positioned within said cylinder, fluid pressure inlet and outlet ports in said cylinder below and above

said free piston, respectively, and flexible conduit means for supplying intermittent fluid pressure impulses to the inlet port of said cylinder.

4. In an electrical precipitator including collecting electrode and precipitating electrode assemblies, a vertical cylinder rigidly attached to an electrode support member and extending freely through a wall of said precipitator, a free piston positioned within said cylinder, fluid pressure inlet and outlet ports in said cylinder below and above said free piston, respectively, and flexible conduit means for supplying intermittent fluid pressure impulses to the inlet port of said cylinder.

5. In an electrical precipitator including collecting electrode and precipitating electrode assemblies, a vertical cylinder rigidly attached to an electrode support member and extending freely through a wall of said precipitator, a free piston positioned within said cylinder, fluid pressure inlet and outlet ports in said cylinder below and above said free piston, respectively, and conduit means for supplying intermittent fluid pressure impulses to the inlet port of said cylinder.

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