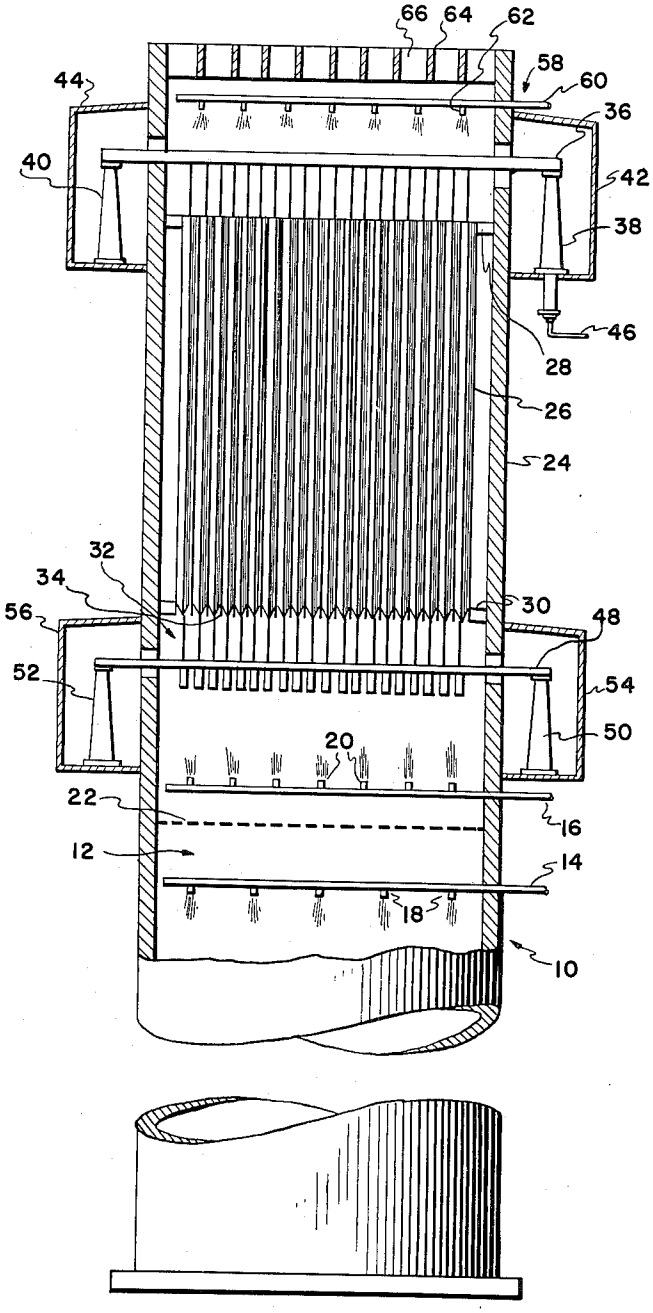
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GAS CLEANING METHOD

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GAS CLEANING METHOD

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This invention relates to a new and improved method for treating and cleaning gases. It is particularly directed to a gas treating and cleaning method wherein gases issuing from aluminum electric furnaces employing plastic pitch type electrodes and containing substantial quantities of fluorine compounds, carbon compounds and tar products are subjected to a succession of cooperating cleaning and treating operations in a single housing.

The invention has particular application to the production of aluminum from alumina by the Soderberg process wherein the electrolytic cell is provided with a continuous self-baking electrode.

Generally the single electrode for the electrolytic cell is formed essentially from plastic pitch. The pitch is added to a hopper at the top of a single, large rectangular, aluminum mantle or casing extending from the cell to a platform thereabove. The plastic pitch is added to the hopper and flows downward toward the metallic bath in the base portion of the cell. The plastic pitch in approaching the metallic bath, is baked by the heat from the cell forming a solid carbon mass. As the carbon in the baked electrode is consumed at the lower end of the anode during electrolysis, more plastic pitch mix is added at the top, and the mantle or shell is added to from time to time, so that the operation is continuous.

While the particular advantage of this process is that it does away with the necessity for a separate plant for the production of the large carbon electrodes the volatile components of the plastic pitch have brought about a substantial air pollution problem. As the plastic pitch electrode is baked, the metallic bath volatizes the volatile components of the pitch, which rise through the body thereof and are expelled through ports on the side of the cell or through an outlet at the top. The gases issuing from these ports contain in addition to fluorine products, carbon compounds, tars and pitches.

It is therefore a primary object of the present invention to provide a method of collecting fume containing substantial quantities of fluorine compounds, carbon compounds and tar products issuing from aluminum electric furnaces employing plastic pitch type electrodes which generally comprises the steps of entraining the fume in a stream of carrier gas, removing a substantial portion of the fluorine compound from said carrier gas stream by subjecting the gas to an aqueous spray whereby the carrier gas is humidified, and thereafter subjecting the carrier gas stream to electrical precipitation between discharge electrodes and complementary collecting electrodes continuously flushed with an aqueous medium to remove suspended particles from said gas in the form of an aqueous slurry.

The fluorine, tar and pitch compounds may then be disposed of in any suitable manner or the fluorine, tar and pitch compounds may be separatedly recovered from the aqueous slurry for subsequent use.

Further objects of the present invention are to provide such a method that is highly efficient, economical and readily adaptable for installation in existing stacks for directing the gases issuing for such electric furnaces to atmosphere.

The invention will be more particularly described with reference to the accompanying drawings showing a preferred form of the apparatus which may be very advantageously employed in the method of the present invention.

Referring to the drawings, **10** generally designates a vertically extending stack into which a carrier gas stream containing the suspended fluorine compounds, carbon compounds and tar products issuing from one or more aluminum electric furnaces is discharged at the lower end. Preferably the stack is cylindrical in cross section and constructed of wood or other material to prevent corrosion by the fluorine compounds. However, the form of the apparatus shown in the drawings is particularly suited for installation in existing stacks for discharging the gases issuing from the electric furnaces to atmosphere.

At the lower end of the stack downstream from the gas stream entrance is provided one or more scrubber sections **12** for removing the greater portion of fluorine compounds and for humidifying the carrier gas. Within the scrubber section are arranged a series of aqueous sprays comprising pipes **14** and **16** having spray heads **18** and **20** positioned at spaced intervals therealong. In the form of the apparatus illustrated in the drawing two sets of spray devices are shown separated by a gas distributing baffle device **22** with the sprays of each unit projecting in a generally vertical direction in opposed relationship.

The gas distributing baffle plate **22** also aids in providing a high velocity means for obtaining intimate contact of the washing liquid with the gas stream flowing upwardly therethrough.

Positioned above the gas washing and humidifying section **12** is an electrostatic precipitation section **24**. In the electrostatic precipitation section of the apparatus there is provided a plurality of cylindrical collecting electrodes **26**, upper header sheet **28**, lower header sheet **30**, and a plurality of discharge electrodes **32**.

The collecting electrodes **26** as shown in the drawing are hexagonal and provided with drip points **34** as described and claimed in U. S. Patent No. 2,592,508, J. Phyl, issued April 8, 1952. The collecting pipes, however, may be square or round as is well known in the art.

The collecting electrodes **32** are suspended from bus bar **36** insulatedly supported at its ends by insulators **38** and **40** mounted in insulator compartments **42** and **44** secured to the outer wall of the stack **10**. Insulator **38** is provided with a high tension inlet conduit **46** which is connected to a suitable source of high voltage electricity. The lower ends of the discharge electrodes **32** are attached to a retaining frame **48** to secure the electrodes from lateral displacement and from swinging from side to side in the gas stream. The supporting frame **48** is secured to the stack by means of insulators **50** and **52** positioned within insulator compartments **54** and **56** which are similar in construction to the insulator compartment **42** and **44**.

Positioned above the electrostatic section **24** is one or more aqueous spray devices **58** which generally comprises a conduit **60** having a plurality of downwardly projecting spray heads **62**. The liquid spray device **58** has three primary functions. It aids in the humidification of the gas stream, it provides a source of water for collecting fluorine compounds not collected in the scrubber section **12**, and provides a film of liquid for entraining the precipi-

tated carbon and tar products in the electrostatic precipitation section 24.

Positioned above the spray section 58 and at the uppermost portion of the stack 10 are baffles or grills 64 and 66 which may be provided to prevent stack cross winds from effecting the distribution of the gases within the precipitator.

In operation of the apparatus shown in the drawing the gases issuing from aluminum electric furnaces employing plastic pitch type electrodes are suspended in a stream of carrier gas and discharged into the lower end of stack 10. The gases entering the lower end of stack 10 pass upwardly through the scrubber section 12 where a substantial portion of the fluorine compounds are removed and the gas stream is humidified. After leaving the spray or scrubber section, the gases pass up through the tower into the electrostatic precipitation section 24 where the tars, pitches and carbon compounds are collected along the inside surfaces of the collecting electrode pipes 26.

The precipitated material is removed from the inner surfaces of the collecting electrodes by the flow of water down the pipes issuing from the upper spray heads 62. The liquid from the precipitator section will then flow through the scrubber section and act as a scrubbing and humidifying medium, augmenting the spray devices 18 and 20 in the scrubber section 12.

From the foregoing description of the present invention it will be seen that the new method of collecting fume from aluminum electric furnaces employing plastic pitch type electrodes fully accomplishes the aims and objects of the present invention.

I claim:

1. The method of collecting fume containing substantial quantities of fluorine compounds, carbon compounds and tar products issuing from aluminum electric furnaces employing plastic pitch type electrodes comprising the steps of entraining the fume in a stream of carrier gas, removing a substantial portion of the fluorine compounds from said carrier gas stream by subjecting the gas to an aqueous spray whereby the carrier gas is humidified, and thereafter subjecting the carrier gas stream to electrical precipitation between discharge electrodes and complementary collecting electrodes continuously flushed with an aqueous medium to remove suspended particles from said gas in the form of an aqueous slurry.

2. The method of collecting fume containing substantial quantities of fluorine compounds, carbon compounds and tar products issuing from aluminum electric furnaces employing plastic pitch type electrodes comprising the steps of entraining the fume in a stream of carrier gas, removing a substantial portion of the fluorine compounds from said carrier gas stream by subjecting the gas to an aqueous spray whereby the carrier gas is humidified, subjecting the carrier gas stream to electrical precipitation between discharge electrodes and complementary collecting electrodes continuously flushed with an aqueous medium to remove suspended particles from said gas in the form of an aqueous slurry, and thereafter subjecting the gas to an aqueous spray whereby the remainder of the fluorine compounds are removed from said carrier gas stream, and passing said carrier gas stream to the atmosphere.

3. The method defined in claim 1 wherein the aqueous medium for flushing the collecting electrodes of the electrostatic precipitator is employed to remove a portion of the fluorine compound from the carrier gas stream.

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