

Plot: Filter (forthcoming, June 2016)

# The Precipitron

Meg Studer

*author's layout copy*

Sept. 13, 1938.

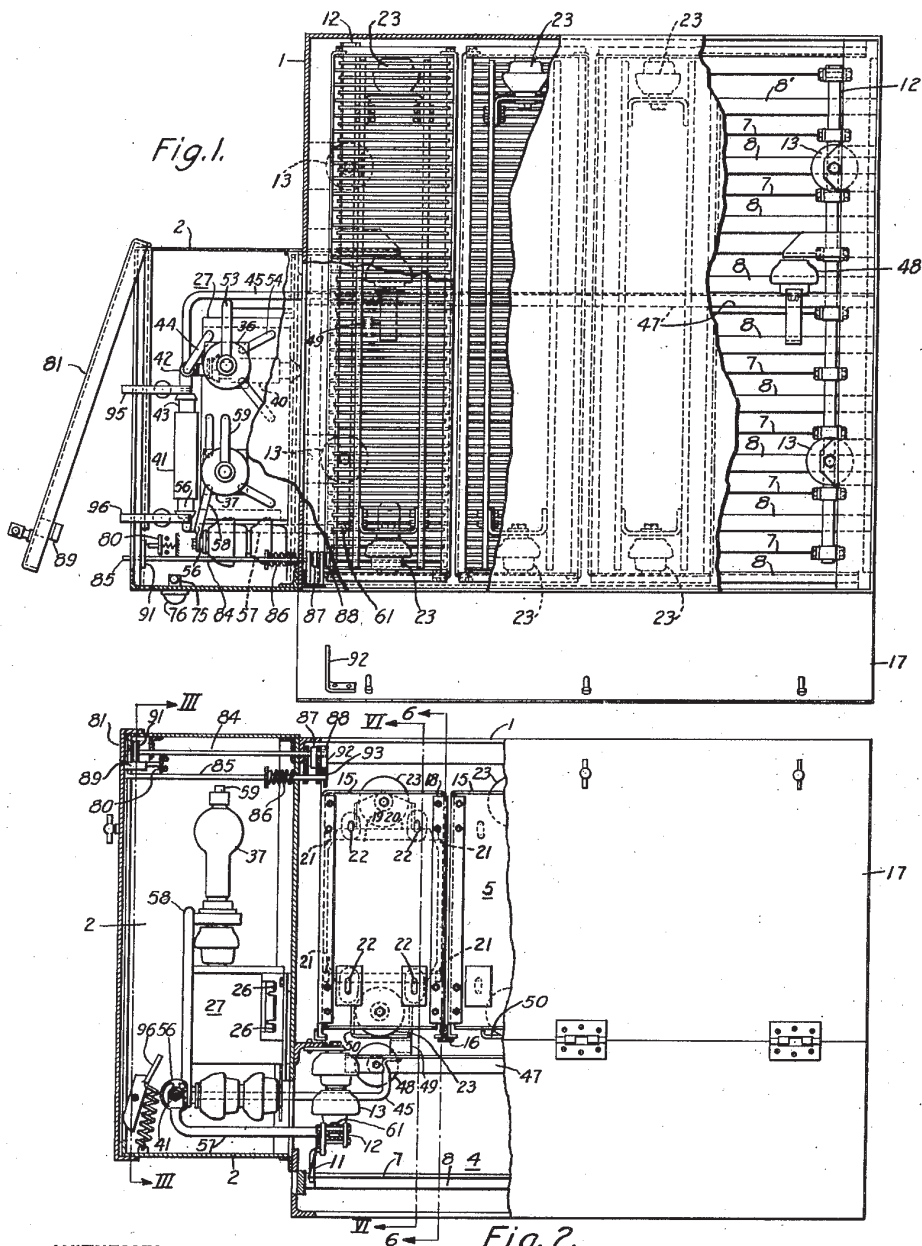
G. W. PENNEY

2,129,783

ELECTRICAL PRECIPITATOR FOR ATMOSPHERIC DUST

Filed Oct. 15, 1935

3 Sheets-Sheet 1



WITNESSES:

*Prod. C. Williams*  
*Chas. C. Groome*

Fig. 2.

INVENTOR

Gaylord W. Penney

BY *O. B. Buchanan*

ATTORNEY

## The Precipitron

My parents, like everyone's parents, have a house brimming with industrial vernaculars. There are the touches one might expect from Pittsburgh: the old coal-bin hatches, a free-standing basement toilet, and a surplus of floor-drains. Styled as a quaint, Elizabethan tudor, the house is constructed from welded steel-beams, corrugated sheeting, and poured-in-place concrete. After WWI, Jones & Laughlin, the steel-mills four miles downstream, simply rebranded their surplus as 'junior-i-beams' to engage inter-war architects. And thus, we find 'heroic modernism' hiding within the house's timid, 'waddle & daub' facade.

More interesting than those hidden, heroic beams are the environmental supports that were supposed to remain invisible. In fact, my favorite vernacular element is the house's not-air-conditioning-but-air-cleaning system, a 1940's Westinghouse Electric 'Precipitron' unit (patent, left).<sup>1</sup> Unused during my post-industrial childhood, the Precipitron's DIY installation nonetheless manifests the urgency of mid-century 'smoke control' and smog particle filtration. With awkward duct-work, the main unit attaches to a crazy array of vertical air intakes and haphazard redistribution vents. Fine oak built-ins and bookcases neatly cover the house's original steam radiators, but the Precipitron ventilation is a labyrinth of aesthetic lapses, infrastructural exposures, and ad hoc concrete cuts; a domestic oddity opening onto the socio-technical constructions of 'air.'

To that end, I'd like to sketch the 'anonymous history' of atmosphere, enclosure, and regulation that the Precipitron manifests. First, this essay will situate 'electrostatic precipitator' development within the much longer battles over coal smoke control and nuisance abatement. Second, we'll look at the mid-century domestic market, as typical of the liberal, gendered approach to pollution (and consumption). I'll wrap by reviewing today's electrostatic entanglements, the on-going externalities of power production.

*Here, in New York, I don't even own window screens or an AC, but, like nearly everyone else, I breath precipitated air.*

## Electrostatic Efficiencies

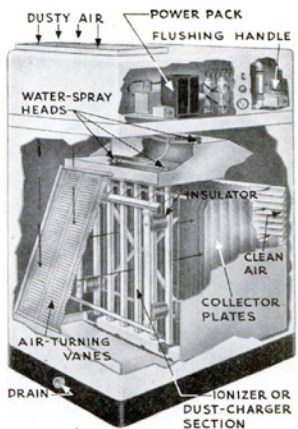
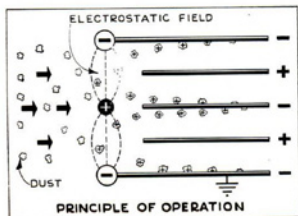
First, what is an electrostatic precipitator (ESP)? These days, it is the most ubiquitous, electrical approach to reducing particulate emissions. As *Popular Science* noted in 1947(right), a precipitator pushes a stream of gas - exhaust or recirculated air- across a positively charged field. This charge transfers to the particulate within that stream. Negatively-charged metal plates attract and collect the particulate. In industrial installations, this dust/residue is collected for by-product reuse or hazardous disposal. Copper-smelting, concrete production, zinc smelting, bessemer steel production, bituminous coal power, and, at a smaller scale, commercial kitchens are typical ESP users.<sup>2</sup> And, in the domestic market, nearly two-thirds of the country has ESP integrated with their HVAC.<sup>3</sup>

Theorized in the 19th century, the first formal patents for ESP were granted in 1919, to Frederick Cottrell. A Berkeley physical-chemist, Cottrell researched how to precipitate arsenic-containing ash out of copper-smelting smoke, minimizing aerial contaminates and (thus) agricultural deaths - cattle, crop, and labor- in California's Central Valley. Frustrated at U.S. corporate hesitancy to install equipment according to pollutant levels, instead of by-product profits, Cottrell decided to share his patents.<sup>4</sup> This enabled wide ranging distribution: by 1929, Cottrell precipitators were installed at Willesden Power Station, London and the Trenton Channel Power Plant, Detroit. But, with owner discretion and municipal statutes as guidance, application was far from systematic. Take U.S. Steel's Pittsburgh mills: at Homestead, they installed ESP's in 1956 but at McKeesport, five miles upstream, placement only happened in 1975, under EPA court order.<sup>5</sup>

Cottrell precipitators, or Westinghouse/Penney's variations were not, of course, the first attempt to deal with industrial smoke and its atmospheric externalities. John Evelyn's rant against the acidic coal-smog of London, *Fumifugium* (1661), proposed the spatial segregation of noxious industries. In addition to breathing improvements and new logistical jobs (between London and its eastern industrial hub), this approach made room for a buffer of 'odiferous Flowers to tinge the aer.'<sup>6</sup> While Evelyn's appeal fell on deaf ears, his logic of parks and program placement was not far from the de-facto, class-based segregations that evolved in industrial cities like Pittsburgh.

April 1947  
Popular Science

**ELECTROSTATIC AIR CLEANER.** Designed for cleaning conditioned and warm air, Westinghouse's Precipitron works on the principle of ionization. Air enters through a duct and passes through a screen of air-turning vanes to an electrostatic field where the dust particles receive a positive electric charge. Negatively charged dust-collector plates attract and hold the charged particles, permitting only clean air to pass through into the house. Efficiency of 85 to 90 percent is claimed. Collected dust in the unit is flushed out by a water spray when cleaning of the unit becomes necessary. Installed in an air-conditioning or heating system, the Precipitron has an air-cleaning capacity of 1,200 cubic per minute, enough for an eight-room house.



APRIL 1947 153

JUST A MINUTE,  
MADAM...



(it shouldn't happen to you!)

Maybe a lot of merchandise *doesn't* stay on some store shelves long enough to gather a coating of store-dust. Even so, we'll bet our bottom dollar that a lot of stores have lost many sales because they simply couldn't do a thorough housekeeping job!

Air-borne dust settles everywhere. Although most annoyingly noticeable on displayed goods, it is also harmful to fixtures, walls and furnishings—causing frequent painting, cleaning and redecorating. It costs a lot of money that *needs* to be spent!

Too, there's a sure way of getting rid of dust and dirt and other particles floating around in the air—Westinghouse Precipitron.\*

This remarkable Westinghouse development *collects* dust and dirt electronically. It operates 5 to 16 times more efficiently than mechanical air filters. Precipitron is the most effective answer science can provide to solve the problem of unclean air.

You can find out more about Precipitron by calling any Westinghouse Office. Or write Westinghouse, P. O. Box 868, Pittsburgh, Pa.

#### WHAT PRECIPITRON DOES

Ordinary mechanical filters permit varying sizes and kinds of dust and dirt to pass through the circulatory system—*not* PRECIPITRON. PRECIPITRON electronically cleans air, even eliminating tobacco smoke particles.

The result of the "Blackness Test," shown at right, indicates clearly what PRECIPITRON can do. Here are actual photographs of the test—where 2500 cubic feet of air, in each instance, was drawn through a cloth area for a 60-minute period. The effectiveness of PRECIPITRON, demonstrated here, will save thousands of dollars resulting each year from damage by air-borne dust and dirt in the home, store and factory.



**Westinghouse PRECIPITRON**  
PLANTS IN 25 CITIES... OFFICES EVERYWHERE

**THE COSTLY NUISANCE OF DUST BANISHED BY PRECIPITRON, FROM...**



Homes, Hotels and  
Apartment Buildings



Laboratories and  
Hospitals



Retail Stores, Banks  
and Office Buildings



Theatres, Restaurants  
and Night Clubs



Mills, Factories and  
Machine Shops

J-64513

October 1945

Architectural Record







June 22, 1959  
*Life Magazine*

familial/social reproduction.<sup>8</sup> The irony, of course, is that this limited model of domestic agency was used to dismiss activists' complaints and appropriate the 'home' for engineering expertise.

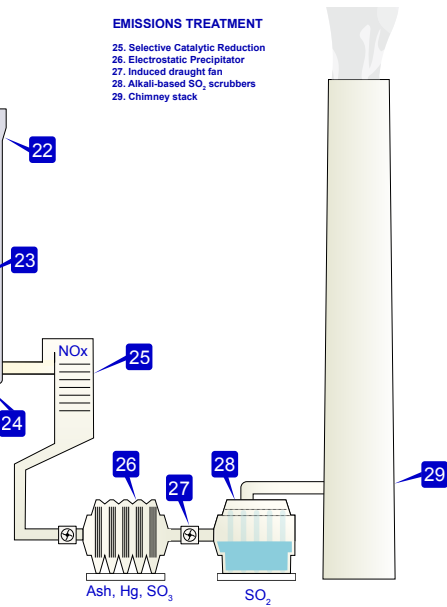
In Pittsburgh, early air-quality reformers such as the Municipal Housekeeping movement (1860s-1910s) used maternal stereotypes to stake out moral ground against pollution. As caregivers, they advocated for healthy living beyond the home, in public provisions of sewage collection, potable water, and clean air. When germ theory undercut the link between moral and environmental improvements, such groups were deemed 'sentimental' and 'frivolous.' In their place, engineering-oriented studies like the Mellon Institute Smoke Investigation (MISI, 1911) used the home – of smoke encrusted fabrics and acidic eroded exteriors – to testify to the inefficiencies of smoke (in labor wasted cleaning and property damage).<sup>9</sup> While more equitable arguments evolved, the Precipitron offers an idea of air-quality narrowly grounded in technical efficiency, property protection, and a regressive version of segregated spheres. It ignores unequal exposures, carcinogenic effects, and the ecological impacts of smoke/particulate that were thoroughly (medically) documented by 1950.





#### EMISSIONS TREATMENT

- 25. Selective Catalytic Reductor
- 26. Electrostatic Precipitator
- 27. Induced draught fan
- 28. Alkali-based SO<sub>2</sub> scrubbers
- 29. Chimney stack



Typ. ESP installation in Thermal Electric Plants  
(adapted Babcock & Wilcox tech. report)

**THERE'S NO MAGIC ABOUT IT!**  
**IT'S JUST**  
*Electronics*  
**AT WORK**

**AIR CLEANING By Electricity**  
gets more than 90% of ALL particles down to 1/250,000 of an inch

There is no mystery about PRECIPITRON—the new Westinghouse air cleaner that operates by electricity. Yet it cleans smoke, haze and dirt out of the circulating air as if by magic. Even tobacco smoke, composed of air-borne particles, is quickly “grounded” by the Precipitron.

Electronics is the secret of Precipitron's exceptional efficiency. Sealed within the venting duct so that all air must pass through it, the Precipitron operates silently, effectively, with no moving parts other than a storage battery. At the front of the unit (or coil), two fine tungsten wires and three grounded rods create a strong electrostatic field. As each particle of dust or smoke passes through this field, it receives a positive charge of electricity.

A series of collector plates are located back of the electrostatic field and as the charged particles pass this area, they are drawn to the oppositely charged plates where they are deposited and adhere. These plates are then cleaned with water and the deposit flushed harmlessly down the drain.

Precipitron's efficiency, far above that of ordinary mechanical air filters, has given a new meaning to industrial air cleaning. For full information write Westinghouse Electric & Mfg. Company, Edgewater Park, Cleveland, Ohio. Ask for folder B-3083.

**Westinghouse Precipitron**  
*Electronics at Work*

PLANTS IN 25 CITIES  
OFFICES EVERYWHERE

A. Electrostatic field at the front of the Precipitron. Here all dirt and dust particles are given a positive charge of electricity.  
B. Series of collector plates, in which charged dirt particles are attracted and adhere.  
\*Trademark registered in U. S. A.

March, 1943  
*The Architectural Forum*

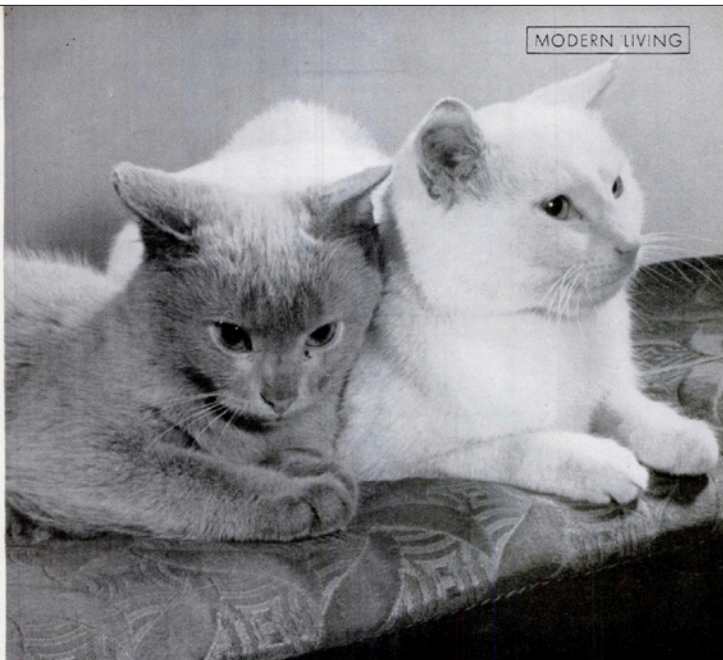
dioxide, sulfur trioxide, mercury, nitric oxide, nitrogen dioxide, and carbon dioxide into more manageable forms.<sup>13</sup> That said, emissions engineering and emissions control does not eliminate pollution. Electrostatic precipitation (and its fly-ash slurries) have simply shifted the vectors of contamination from air into land-based confinement.<sup>14</sup>

There are still outstanding environmental and social costs tied to ‘clean coal’. The New York Academy of Sciences recently estimated that the residual emissions and carcinogenic contamination from precipitated fly-ash amounts to public health costs of between \$.08-.16/kWhr (climate costs double this number).<sup>15</sup> As a Con Ed residential user (rates \$.11-.30/kWhr off-peak/peak), I’m only paying about half of the ‘true’ cost of power.<sup>16</sup> As a society, we still need to develop more wholistic regulations to address the sources and extended externalities of our energy addictions.

We can’t expect too much from those mid-century, DIY precipitator installations. To pun on Westinghouse’s own ads, ‘*There’s no magic about it! It’s just electricity.*’

# Notes

- 1) See Patents #: US2129783, US2347709, US2382254 at Google Patents. [www.google.com/patents/](http://www.google.com/patents/).
- 2) White, Harry. "The Role of Electrostatic Precipitators in Particulate Control." *J. Air Pollut. Control Assoc.* 25:2 (February, 1975). 102-107.
- 3) "Residential Energy Consumption Survey (RECS)." [www.eia.gov/consumption/residential/reports/2009/air-conditioning.cfm](http://www.eia.gov/consumption/residential/reports/2009/air-conditioning.cfm).
- 4) LeCain, Timothy. "The Limits of Eco-Efficiency" *Environmental History*, 5:3 (July, 2000). 336-351.
- 5) GCA Corp. "Air Pollution Control Equipment Inventory." Draft Final Report for the EPA. (February 1982).
- 6) Jenner, M. "The Politics of London's Air." *The Historical Journal* 38:3 (1995), 535-551.
- 7) Good intro to this narrative in Biehler, Dawn Day. *Pests in the City*. (Seattle: U. Washington Press, 2015). 3-54.
- 8) General biopolitical theorization of gender in Donzelot, Jacques. *The Policing of Families*. (Baltimore: Johns Hopkins University Press, 1997).
- 9) Gugliotta, Angela. "Class, Gender, and Coal Smoke" *Environmental History*, 5:2 (April, 2000). 165-193.
- 10) Rouche, Berton. "The Fog" *The New Yorker*. Sept. 30, 1950.
- 11) Davidson, C.I. "Air Pollution in Pittsburgh" *J. Air Pollut. Control Assoc.* 29:10 (October, 1979). 1037, 1040.
- 12) Liptak, Adam and Coral Davenport. "Supreme Court Deals Blow to Obama's Efforts to Regulate Coal Emissions" *The New York Times*. February 10, 2016.
- 13) Moretti, A.L. "Advanced Emissions Control Technologies for Coal-Fired Power Plants" (Technical Paper BR-1886). Presented to Power-Gen Asia. October 2012.
- 14) Goldstein, Robert J. "Lessons from Uniontown: Polluting Civil Rights." posted on *Dot Earth Blog*, *The New York Times*. January 19, 2015.
- 15) Epstein, Paul et. al. "Full Cost Accounting for the Life Cycle of Coal." *Annals of the New York Academy of Science* 1219: Ecological Economics Review (2011): 73-98.
- 16) Con Edison Residential Rates (registered with NYS, pdf p424). <https://www2.dps.ny.gov/ETS/jobs/display/download/5808980.pdf>



CAT AT LEFT LIVES IN ORDINARY PITTSBURGH HOUSE, IS REALLY PURE WHITE JUST LIKE THE ONE ON THE RIGHT WHICH LIVES IN PRECIPITRON-EQUIPPED HOME

## DIRTY AIR

### PRECIPITRON, AN ELECTRONIC FILTER, WILL KEEP HOMES CLEAN

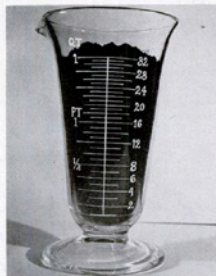
Each year 1,000 tons of dust and dirt, enough to fill 50 railroad coal cars, settle down over the streets, the buildings and the inhabitants of Chicago's Loop. Chicago's air is no dirtier than that of most big U. S. cities which sometimes contain 3,000,000 particles per cubic foot. These tiny specks get in people's eyes, pile up on their window sills and soil their curtains, their walls, their cars (above). The annual U. S. cleaning bill as the result of dirty city air runs to about \$1.5 billion dollars, almost as much as Americans used to spend each year on automobiles.

A few U. S. families have been able to cut out cleaning costs and add to their comfort with a device called the Precipitron. Developed by G. W. Penney of the Westinghouse Co., it removes from the air, electronically, 99% of all smoke and dust.

To keep a home clean with the Precipitron the win-

dows must be closed and the house ventilated mechanically. The Precipitron is placed in intake ducts of air-conditioning systems or a forced hot-air furnace, cleans air as it is drawn in (see p. 72). With such an installation, about the only dirt that can get into a well-built house is that tracked in or brought in on clothes and packages. Sweeping and dusting become biweekly instead of daily chores, and furniture, rugs and woodwork almost never have to be washed or cleaned. Because the Precipitron also removes most of the pollen from the air, it is helpful to hay-fever and asthma sufferers.

Mechanical ventilating systems with which Precipitrons can be used will be more plentiful after the war. A Precipitron unit itself, large enough for an average six-room house, consumes about as much electric current as a 60-watt bulb and will sell for about \$425.



Quart of dirt in three weeks was filtered from the air of a Pittsburgh suburb by a Precipitron in an eight-room house.

April 30, 1945  
*Life Magazine*



1956 ESP installation  
U. S. Steel's  
Homestead Mill  
HABS/HALS