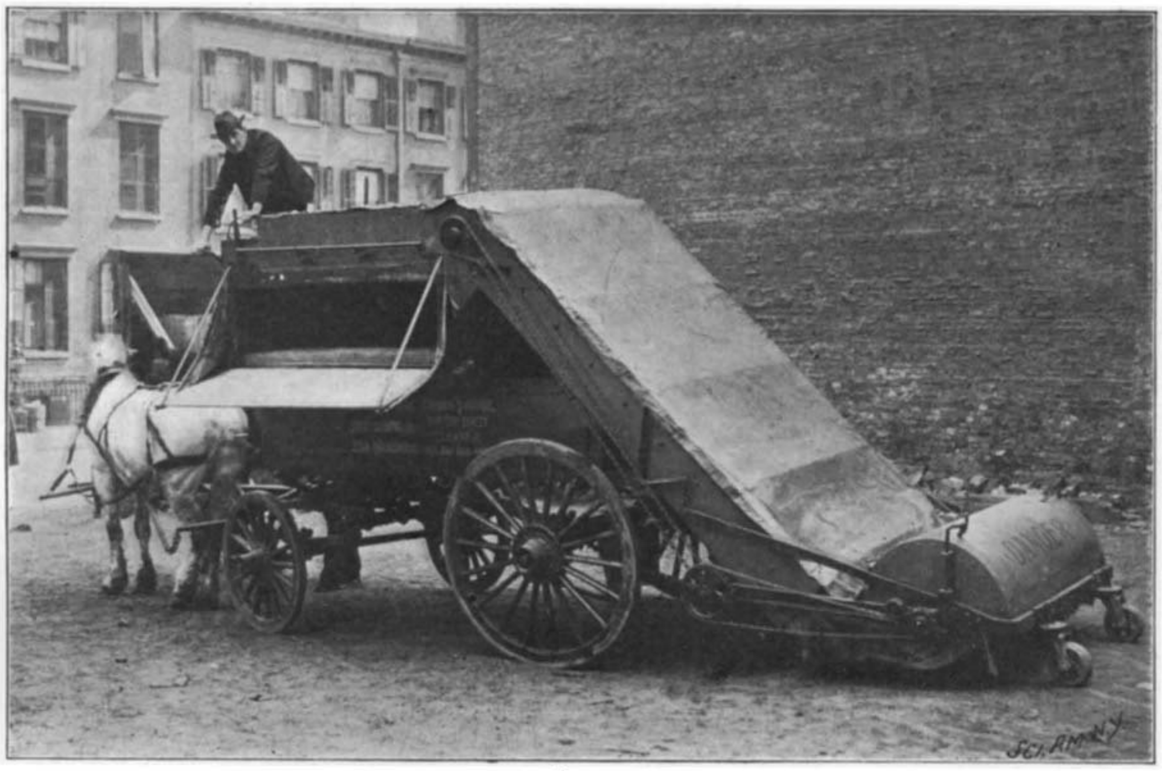
viated, and the rolling stock generally is kept in a state of cleanliness which is impossible on a line where coal is used as a motive power.

NEW SYSTEM OF STREET CLEANING.

Some of our readers, passing up Fifth Avenue recently, may have noticed the new street-cleaning device used on that thoroughfare. A clear understanding of the machine can be quickly had by a glance at the diagrammatic view shown herewith. The rotary sweeper, *A*, at the rear of the machine is operated by chains and sprockets from the hubs of the rear wheels, and serves to gather up and throw the dirt onto a slide, *B*. Moving over this platform is an endless belt, *C*, on which are a series of scrapers that carry the rubbish upward and forward until from the top of the slide it drops into the dust-proof box, *D*. In order to prevent the rubbish from accumulating at the rear end of this box and choking up the mouth of the elevator a conveyor, *E*, is provided, which moves the dirt toward the front of the box as soon as it has piled up within reach of the paddles on this belt. Both the elevator and the conveyor belts are driven by chain gearing from the rear wheels. A large water tank, *F*, is situated below the rubbish box and, under control of the driver, feeds the sprinkler, *G*, placed directly in front of the sweeper.



A SANITARY STREET-CLEANER.

The advantages of this machine are evident. It does its work thoroughly and quickly without raising any dust; for the matter is first sprinkled and then raised through a covered elevator to a dust-proof receptacle. The whole operation is therefore under cover—a point which cannot be too strongly emphasized in any work which stirs up the heterogeneous filth of a city street. The machine holds two cubic yards of dirt, and the whole process of sprinkling, gathering and dumping can be controlled by a single man. The method of dumping the dirt is an interesting one. Referring again to the diagram we notice that the bottom of the rubbish-box is an endless sheet of iron which passes around rollers, *H*, placed along each side of the machine. These rollers are rotated by operating a lever at the driver's seat. Our engraving shows the door of the rubbish-box let down to form a chute for the dirt, and the driver may be seen operating the dumping lever. By rotating the pulleys the floor is fed forward, forcing the rubbish out onto the chute, whence it slides into a dump-cart or any receptacle placed thereunder.

This machine should work a revolution in the present antiquated methods of street cleaning. The slow, cumbersome operation of sweeping cobblestones by hand, aside from being expensive, is at the same time most unsanitary; for the rubbish is continually being stirred up and laid open to the air, giving off bad odors. This machine, however, seems to fill all requirements; it sweeps on an average seventy thousand square yards of street per day at half the cost of hand labor and does the work without spreading any dust, odor or disease.

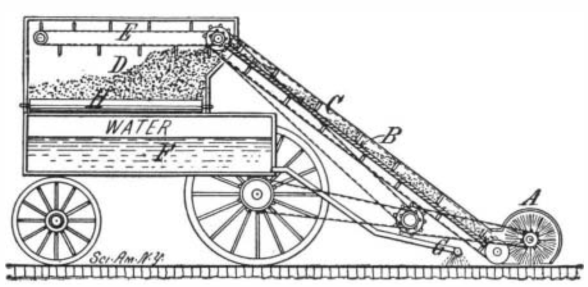


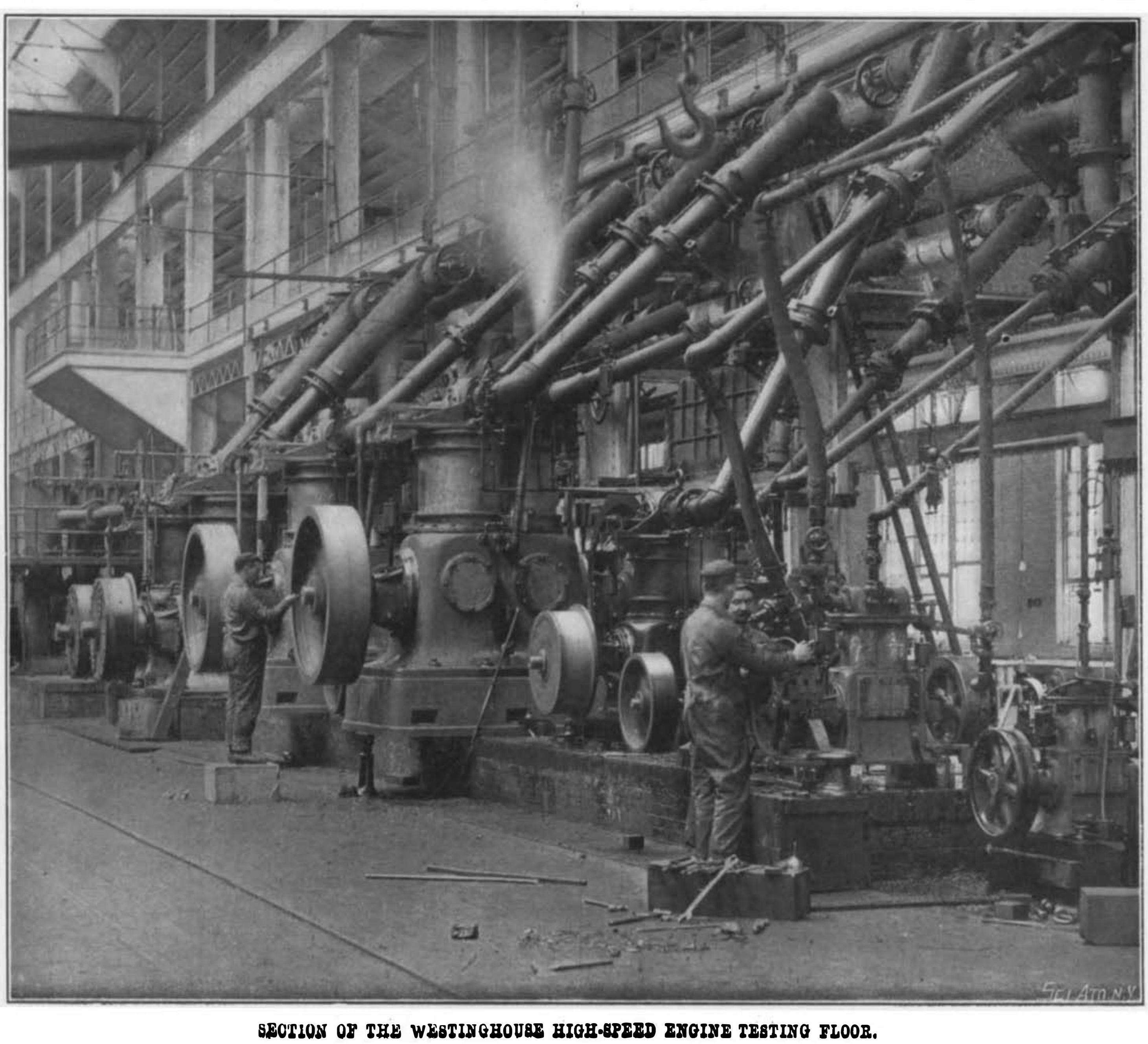
DIAGRAM OF THE STREET-CLEANER.

THE TESTING OF HIGH-SPEED ENGINES.

The testing room of the Westinghouse Machine Company's works is one of the most important and interesting features of the establishment. Extending down one side of the room is a long foundation bed, capped with plates which are slotted for holding-down bolts, which is capable of accommodating at one time as many as a dozen engines of sizes varying from 5 to 500 horse power. Above the testing bed, and at sufficient height to accommodate the larger engines, is a main steam pipe to which is connected a series of adjustable pipes, with swinging and extension joints. Behind the foundations are three surface condensers varying from 300 to 1,000 horse power capacity, while beneath each condenser, and mounted on platform scales, are two weighing tanks with suitable connections for delivering the water to one or the other, as desired. Each condenser is supplied with a vacuum pump, to enable the test to be made with the engine exhausting into a vacuum should a test of this nature be called for.

Every engine that is made in the Westinghouse shops is ultimately sent to the testing department, where it is set up and connected to steam and exhaust. A friction brake is put on the crankshaft and the engine is given a service test of from 20 to 60 hours, the duration depending upon the size of the engine. The object of this test is to regulate the governor and to develop any latent defects which might have escaped inspection at the erecting shops. When the run is ended the indicator is applied and the exhaust is turned into one of the surface condensers, the brake load and the steam pressure being maintained at a constant figure. This test is known as the duty test, its object being to determine steam consumption at rated load, and also at half and quarter load. During the test, indicator diagrams are taken, and the water coming from the condenser is weighed at frequent intervals and the results computed and entered on a record blank.

The system of testing is carried out with a view to determining both the steam consumption per indicated horse power and also the steam consumption per net or delivered horse power, the latter being the indicated horse power less the friction losses in the engine itself, and, therefore, the power actually available on the crankshaft. The tests as thus carried out are in no sense "laboratory tests." The conditions, moreover, are not



SECTION OF THE WESTINGHOUSE HIGH-SPEED ENGINE TESTING FLOOR.

by any means favorable to the engines. Thus, the boilers which supply the testing room are 150 feet away and are forced much above their normal rating, and as a result, the steam is far from dry. The adjustable piping, moreover, is uncovered and contains many valves and right-angle turns, the cylinders have no packing of any kind, and the piston rings and cylinders have not worn down to that smoothness which conduces to the best economy. Hence it has been found that the tests made at the time of delivery are in every case exceeded in results by tests taken after the engines have been delivered and have been for some time at work. The magnitude of the work carried on by the Westinghouse Machine Company may be judged from the fact that the work of the testing department involves the steady consumption of over 500 horse power of steam and the unremitting services of seven men, without including the fireroom labor and the work of pumping the water for cooling the brakes and for condensing. It is considered that the expenditure is fully justified, seeing that it relieves the company of all subsequent annoyance and expense in the way of correcting errors after the engine has been sent out.

Engineering Notes.

Dresden boasts of a novel method of heating its Royal Castle, Royal Opera House and Police Headquarters. The heat is conveyed through pipes. So great is the distance in some cases that the furnace is known in the town as the "long distance heating apparatus." It might seem that the loss of heat must be enormous, but reports received seem to indicate that the system works admirably.

A coal field in Asia Minor, situated in the northeast of the peninsula on the North Sea littoral, and about 140 miles from Constantinople, is being worked with some vigor, says The Engineer. The two principal ports of shipment are Heraclea and Zoungouldak. As a bunkering coal, an independent examination on behalf of the British Admiralty condemns it on account (1) of excessive clinkering, and (2) of a too high percentage of impurities to enable it to be used with advantage where a large amount of coal is required to be used per square foot of fire-grate. The quality tried for the British Admiralty contained 15 to 20 per cent of ash, and other qualities contain as much as 50 and 60 per cent.

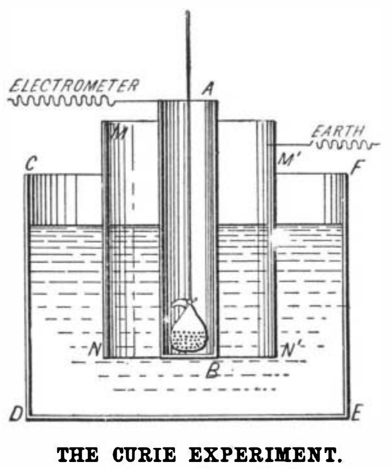
In some parts of the country no true coal exists, but lignite is found in greater or less quantities. Its heating value, as compared to coal is as 11 to 14, but it can be burned to advantage as fuel for steam boilers if the grates are made very large and correspondingly deep. There is a difference in the quality of lignite as in all other things, some of it being very wet. The heating surface should be not less than 40 to 1, or about what is used for anthracite. Lignite burns freely, being very light, and requires frequent firing, and, for that reason is very apt to be condemned by those who attend to that duty, but is no worse in this respect than soft coal screenings, of which quantities are used daily.

The loss of gold in the final tailings from a free-milling plant, with concentrating tables and either cyanide or chlorination treatment, is not a fixed value, says The Mining and Scientific Press. It varies with different ores and with different localities and cost of facilities. The effort to recover values stops short in every case at the point where the recovered value becomes equal to the cost of getting it. There are instances where it is less than 20 cents a ton, and claims have been made as low as 8 cents a ton, and again losses are recorded as unavoidable that are as high as $1.50 a ton. Anything over 50 cents a ton should be made the subject of a thorough questioning analysis before it is accepted as the acme of good milling practice.

In the year 1878 Dr. Flugge proved that air will go through the walls of a closed room, at a rate depending mainly on difference of temperature between the inside and the outside—the latter being the lower. With walls of ordinary thickness he found that about one-fourteenth of the air in the room would be changed per deg. C. per hour. In other words, if the outer were 14 deg. C. colder than the inner, the air of the room would be completely changed in an hour by transpiration through the walls. M. H. Wolpert has re-examined this subject, and he finds that in a chamber of 60 cubic yards capacity, having walls of masonry covered with paper, the air will be changed at the rate of one-fortieth of its volume per deg. C. per hour. When the paper on the walls contained oil-varnish decidedly less air permeated, while without paper at all much more went through. It is desirable, therefore, that the exterior of houses should be clean, and a heavy rain is a blessing in this respect. Also it follows that the greater the difference between inside and outside warmth the more copious this spontaneous ventilation. Pettenkofer found that when materials like slag and glass were used, through which air could not pass, the cements employed were, as a rule, highly permeable.

EXPERIMENTS OF M. CURIE.

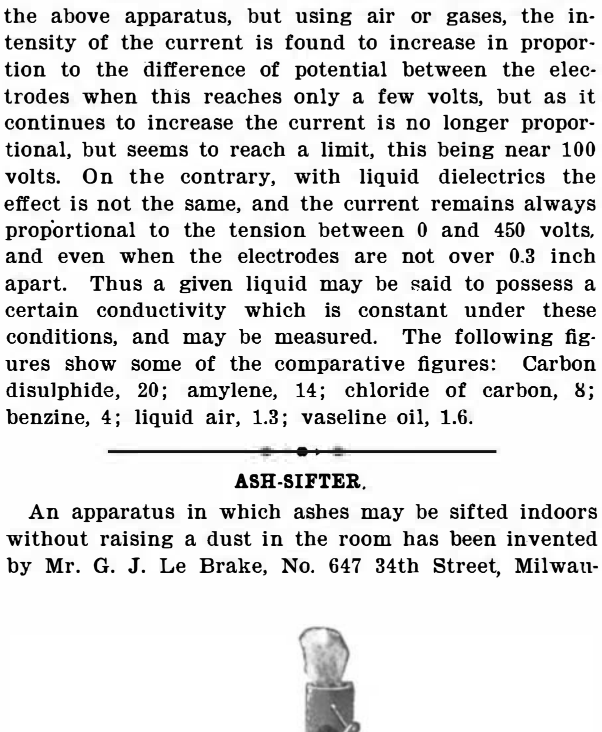
M. Curie has been making a series of experiments upon the action of radium rays and also of the X-rays upon various dielectrics. It has been already found that these rays increase the electrical conductivity of air and gases, and M. Curie now finds that they act in the same way upon liquid dielectrics. In the experiments which he describes before the Académie des Sciences he uses the arrangement shown in the diagram. The liquid to be experimented with is placed in a metallic vessel, *C D E F*, into which is plunged a thin copper tube, *A B*, and these two vessels act as electrodes. The outer vessel is kept at a constant potential by a storage battery, of which one pole is connected to earth. The tube, *A B*, is connected to an electrometer. When the current traverses the liquid, the electrometer is brought back to zero by an opposing potential, and this gives the means of measuring the current passing through the liquid. The copper tube, *M N*, *M′N′*, connected to earth, acts as a guard to prevent the current from passing across the air. The radium compound is placed in a small glass bulb at the bottom of the inner tube and its rays act upon the liquid after traversing the walls of the tube. To operate with X-rays, these are sent up from below against the bottom of the vessel, *D E*. In both cases all the liquid dielectrics seem to show an increase of conductivity when acted upon by the rays. When the action is observed with the above apparatus, but using air or gases, the intensity of the current is found to increase in proportion to the difference of potential between the electrodes when this reaches only a few volts, but as it continues to increase the current is no longer proportional, but seems to reach a limit, this being near 100 volts. On the contrary, with liquid dielectrics the effect is not the same, and the current remains always proportional to the tension between 0 and 450 volts, and even when the electrodes are not over 0.3 inch apart. Thus a given liquid may be said to possess a certain conductivity which is constant under these conditions, and may be measured. The following figures show some of the comparative figures: Carbon disulphide, 20; amylene, 14; chloride of carbon, 8; benzine, 4; liquid air, 1.3; vaseline oil, 1.6.



THE CURIE EXPERIMENT.

ASH-SIFTER.

An apparatus in which ashes may be sifted indoors without raising a dust in the room has been invented by Mr. G. J. Le Brake, No. 647 34th Street, Milwaukee, Wis. As shown in our illustration, the sifter comprises a trunk or body pivoted at the rear to a frame and resting at the front end, when in use, on an ashcan or bucket. Mounted within this body is a sling in which the sifter-pan is held. A handle on the sifter-pan extends through the end wall of the box, and may be operated to give the pan a reciprocating motion. Directly below the sifter-pan is a funnel or spout which extends through the floor of the body, and fits tightly into the ash-can below when the apparatus is in operative position. At the rear end of the body is a pipe which may be connected to the flue or chimney of the house and through which the dust can escape. A damper in this chimney is connected by a lever to the body of the sifter, so that when the latter is in its operable position the damper is open and permits free escape of the dust, but when the body is raised the damper is closed and prevents a current of air from passing unnecessarily through the apparatus. The body is raised and held in its upper position to permit of readily removing the ash-pan after the ashes have been sifted. Two levers pivoted to the frame, one at each side of the body, and connected by a bar at the top, serve to hold the apparatus in this raised position, a notch in each lever supporting a keeper on the body. The notched edges of the levers are kept by spring tension into contact with the keepers.


A DUSTLESS ASH-SIFTER.

When it is desired to use the apparatus, an ashcan is placed in proper position under the funnel, and then a forward pull on the supporting levers permits the body to drop and wedge the funnel into the mouth of the ashcan. At the same time the damper is automatically opened, permitting a current of air to carry up the chimney all dust arising from the ashes as they are poured into the sifter-pan. As soon as this has been done, the cover of the box is closed and secured, after which the handle can be operated to sift the ashes without the slightest danger from dust and dirt. The wing-like side pieces on the cover are adapted to lie against the sides of the body and insure a perfect connection between the lid and the trunk.

New York's Crematory for Light Refuse.

It will be remembered that the late Col. George Waring was a strong advocate of the disposal of city refuse by incineration, and that he had even gone so far as to build an experimental plant in which the city's garbage was to be burned. The idea has been again taken up by Dr. Woodbury, the present Commissioner of Street Cleaning, who has commissioned Mr. H. de B. Parsons, of New York city, to prepare plans for a raffle incinerator, which is nothing more or less than a crematory for the burning of light refuse.

Mr. Parsons' plans have been completed, submitted to the Commissioner, and approved. The result is that an experimental crematory built in accordance with these plans will soon be erected.

At present New York's light refuse is carted to docks, is there loaded on scows and towed out to sea, together with garbage and ashes. This light refuse, composed chiefly of boxes, mattresses, waste paper and the like, is disposed of at a certain price per yard. By burning this material it is hoped to effect a very considerable saving.

The plant will be erected at the foot of West Forty-seventh Street. The carts containing the light refuse will dump their loads into hoppers closed by counter-balanced doors. From the hoppers the refuse passes from a ledge to a drying table back of the grates. Here the material is partially dried by heat. The next stage in the process is to convey this dried material to the fires.

Three fire-boxes are provided. The refuse is not to be discharged into the furnace simultaneously, but onto one grate at a time. In this manner it is possible for the gases of combustion from one grate to mingle with those of a hotter furnace. The products of combustion, having passed through the length of three grates, are conveyed back to the furnace to a point beneath the drying table, where they are utilized in drying the refuse that comes from the hoppers. From beneath the drying tables the gases may be discharged directly to a 114-foot stack or else beneath vertical boilers near the stack.

The plant is to be regarded simply in the light of an experiment. Its primary purpose is to show that it is cheaper to burn light refuse than to dispose of it otherwise, and that a crematory can be maintained within the city limits without in any way becoming a nuisance.

The Current Supplement.

The first article of the current Supplement, No. 1375, is a handsomely illustrated description of the New York Zoological Garden. Mr. John Hughes discusses very thoroughly the subject of the utility of alkaline phosphatic manure. Just now the metric system is very much the subject of Congressional interest. For that reason the report of the committee on the bill providing for the adoption of the metric system by the government of the United States should be of interest. The report will be found in the Supplement. Prof. Henri Moissan tells something of a new treatment of niobite and of the preparation and properties of cast niobium. The interesting description of electric furnaces begun in the last issue of the Supplement is concluded. Mr. E. C. Handy explains from the electro-chemical standpoint the use of cadmium in testing storage batteries. The usual Consular Notes and Selected Formulæ are published.