Continuous grates in one chamber are supplanting individual cells and grates and the advantage is evident. In the case of individual or single cells when refuse is charged into the furnace it has the tendency of lowering the temperature of that cell, and the effectual mixture and burning of the gases must take place in the combustion chamber. Whereas, in the case of the continuous grates, two or more grates are built side by side in one chamber with independent ash-pits beneath. When any refuse is charged onto any one of these grates, the cooled gases therefrom are mingled and burned in the furnace itself and no gree gases can escape into the combustion chamber without first passing over an incandescent body. Meldrum's Simplex Destructor was the first constructed on this principle and its usefulness was appreciated by other makers. Heenan and Froude, Horsfall, Fryer, Dawson and Manfield and other destructor builders now design some form of continuous, twin or series grates.

Mechanical stoking and clinkering and other forms of labor-saving devices are installed in a number of destructors. Boulnois and Brodie's charging trucks, Marten's charging apparatus, Horsfall's tub feed, Heenan and Froude's hydraulic feeder and others are examples of the methods most in use. Heenan and Froude's trough grate and hydraulic ram clinkering machine and Sterling's clinkering grate are installed in many plants. According to Mr. Fetherston's report[7] the arduous work of charging and clinkering at the Clifton (New York) destructor has been reduced by the use of the hydraulic ram charger and clinkerer and trough grate. The following figures are extracted from his report:

Comparison of Work Elements.—Official Tests.

Plant. Both in New York.	Cost per ton supervision and labor.	Pounds burned per furnace man per hour.	Pounds burned per sq. ft. per hour.	Per cent. of time furnace door open.
West New Brighton, 1908	$0.76	1,357	54.3	73.7
Clifton, 1913	0.41	3,330	144.2	5.1

Mr. Fetherston, however, expresses his opinion that some time must elapse before the complete economy of the mechanical devices is demonstrated.

Conveyors have been tried in several installations, but owing to the heterogeneous character of the refuse, they have not always been found to answer. The same remark applies to refuse elevators, etc. The three buckets and rake elevators in use at the Hackney destructor (London, England) capable of raising 10 to 12 tons per hour, are found to be very expensive to maintain and are liable to serious breakdowns.[8]

Hoppers or storage bins above the destructor furnaces are often found to be unsatisfactory, owing to the tendency of the refuse to bind and arch over the opening, and the bulky nature of the refuse often renders the hoppers inadequate in capacity, in which case some city authorities store the refuse in the carts or wagons and thus obviate creating of nuisance. In some cases the refuse in bins tends to ignite and cause an emission of noxious gases. In recently built destructors the hoppers are located behind or in front of the furnaces and are sufficiently large to hold one or more day's supply. Such a position is both cool and handy for hand-firing.

In the more recent developments of destructors the authorities have observed that it was possible to derive considerable steam power. The ordinary steam-producing capacity of destructors is calculated at one pound of steam for each pound of refuse burned, and as one horse-power may be based on 30 pounds of steam per hour, it will be seen that one ton (2,000 pounds) will, on the above basis, produce 67 horse-power, but a large quantity of steam is required for the plant itself, so that the net quantity of steam available for other purposes is less.

[7] J. T. Fetherston, New York, February, 1914.

[8] Journal of Institution of Municipal and County Engineers, July, 1914.

There are plenty of instances where the production of steam has exceeded one pound per pound of refuse.

Official tests made at the Clifton destructor in 1913 with a winter mixture of refuse gave a gross equivalent evaporation from and at 212 deg. Fahr. of 1.00 to 1.11 pounds at a pressure ranging from 117 to 126 lbs. per square inch, but at the West New Brighton destructor the results were 1.10 to 1.41 pounds of steam at a pressure of 130 to 137 lbs. per square inch. The production of steam during the year 1911 was 1.23 pounds per pound of refuse.[7]

In Milwaukee, the evaporation was 1.34 to 1.45 pounds and at Westmount, P.Q., from 1.48 to 2.11 pounds.[4] In Calgary, Alta., the average evaporation at tests was 1.13 pounds. In Darwen (England) the average evaporation during the year was 1.23 pounds, whilst on a test when burning unscreened refuse and slaughter-house refuse was 1.55 pounds of steam from and at 212 deg. Fahr. In Huddersfield (England) with one part of sewage sludge and two parts of refuse 1.4 pounds of steam were obtained.

A test was made in Rochdale (England) for the purpose of comparison. By using ordinary coal slack having a calorific value of about 12,500 B.t.u. 7.33 pounds of steam were produced from and at 212 deg. Fahr., as compared with 1.97 pounds from refuse.[9]

At Montgomery (Ala.) in 1911 the following test results were secured: 1.37 pounds of steam per pound of refuse; carbon dioxide in the waste gases, 11 per cent.; temperature in combustion chamber, 1,920 deg. Fahr. The refuse consisted of 25 per cent. ashes, 42 per cent. garbage, 13 per cent. rubbish, and 20 per cent. manure.

The steam produced by burning refuse is utilized for a variety of purposes, such as pumping sewage, or water, generating electricity, etc.

Part of the steam generated from refuse in London, Ont., is used for heating the Victoria Hospital, which is situated fifty feet away. In one city 72 million foot-pounds of energy is derived from every ton of refuse and used for pumping sewage. In Liverpool and Rotterdam, for example, the electric energy generated is used for street railway operation. In West New Brighton and Clifton plants, already referred to, a large quantity of steam is not utilized owing to the fact that the New York City charter prohibits its sale and consequently no revenue can be derived in this manner. This represents a loss of about $7,500 per annum. The quantity of refuse burned at each of these places is about 9,500 tons per year. In Westmount, P.Q., the destructor is an auxiliary enterprise operated in the same building as the municipal electric lighting plant, the steam generated by the cremation of the refuse being used in the production of electrical energy. Messrs. Hallock and Runyon, the engineers who were appointed to report on the disposal of refuse by the City of Newark,[4] stated that the total revenue in 1910 for electric lighting and destructor plants was $102,149.17, and the total cost of operation of the combined plant was $75,426.38, leaving a net profit of $26,722.79. The operating costs include all capital

[9] Refuse Disposal and Power Production, Goodrich.