

Garbage in Working Clothes

The Efforts Now Being Made to Get the Value Out of This Municipal Waste

By Harry A. Mount

IF methods of garbage disposal now in use in this country fall short of the ideal, it is not because there has been a dearth of effort to improve these methods. In an article which recently appeared in this journal, the writer showed how plant after plant for garbage disposal had been closed, until we are faced with the threat that the progress of forty years in the art will be swept away by an unfavorable combination of economic conditions.

The publication of this article has evoked a wide range of comment and has brought to our attention no less than six proposed systems of municipal garbage disposal, each of which aims to reduce the heavy loss now involved in disposing of this waste, or actually to turn it into a profit.

The most widely used of modern disposal systems are based on the idea that garbage contains valuable ingredients which can be salvaged in salable form as greases and fertilizer values. These proposed systems open a much wider field of possible profit from garbage, for it is proposed to manufacture from it such commodities as cardboard, paper, dressings for fabrics and leather, fuel, oils and chemicals.

It is no secret that the garbage collected by every municipality contains raw material for making all of these products and many others. The wonders of modern chemistry make it possible to extract and use them. But the difficulty has been that these materials are not present in sufficient proportion to make their extraction profitable in competition with more abundant sources of raw material. Whether these inherent difficulties have been overcome by the inventors of new processes of garbage disposal remains still for future determination, for in no case where a revolutionary process is claimed has the idea progressed beyond the experimental stage. Until such systems are demonstrated under commercial conditions their value will remain problematical. In one case only there has been such a practical demonstration, and here the aim has been not so much to develop along new and untried lines but to improve an existing method to make it cheaper and more efficient.

The fact that these new systems have not yet been demonstrated under working conditions, does not mean, however, that they will be of no future value. Perhaps one or more of them will prove a practical solution for what is now a very perplexing municipal problem. It may, therefore, be of interest to report them briefly here.

The statement that five of the six systems have not been tried on a commercial scale ought, perhaps, to be qualified, for one of them, according to its promoters, is being successfully used in several Italian cities. The system was designed by an Italian scientist and had its origin in the custom, on many Italian farms, of dumping all manure, sweepings, dead leaves, kitchen garbage, and like wastes into a bin, where they are allowed to rot and the resulting compost is used as manure. The new scheme consists of building a multiplicity of cement tanks of a definite capacity, each ventilated by a type of condensing ventilator which returns to the compost the materials which would otherwise escape as gases. For a time after the garbage has been placed in the tanks it is kept moist by pumping over it the liquid drained off beneath. It is claimed that during the period of putrefaction the material heats itself to a degree said to be sufficient to destroy all germ life and that at the end of about 45 days there remains only a dry, sterile, and almost odorless compost of high fertilizing value.

Members of a firm which contemplates introducing this system in this country admit that they will have to take into consideration conditions here. The char-

acter of American garbage is very different from that of European garbage because American housewives are more wasteful of food and because no plea has been found effective in keeping out of the garbage such materials as bottles, cans, broken glass, bones and old metals. Also, differences in climate may affect the process. Advocates of the scheme claim for it that it can be built as economically in small as in large units,

he proposes would operate substantially as follows:

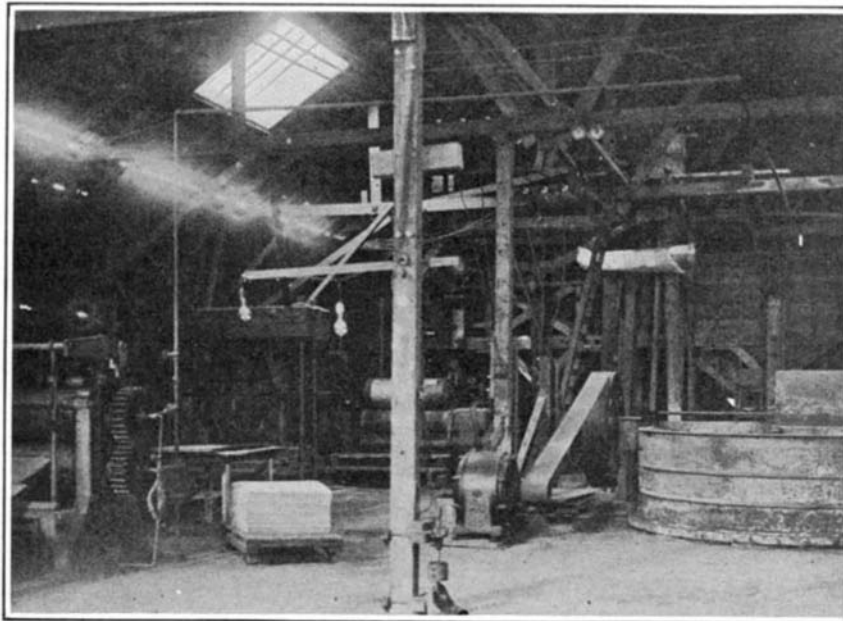
The garbage would be delivered to receiving bins, from which it passes to a rotary screen to loosen up the garbage before passing to a conveyor belt. As it passes along this belt men would pick out all objectionable matter such as glass, bones, iron, bottles, wood, tin cans, etc. A hood is placed over this conveyor and all odors are blown to the boiler firebox. From the conveyor the garbage would drop to a shaking screen to remove sand and dust and then would be elevated to bins in the top of the building, from which point it would move by gravity. From these bins the digesters would be loaded, the garbage to remain in these rotary digesters (cookers) for two hours under 150 pounds steam pressure with water. The water, after cooking, would be discharged into shallow pans, from which the grease later would be collected. The plan then contemplates refilling the digester with water, together with the proper chemicals to sterilize and remove all soluble matter, and cooking from two to three hours. The pulp then coming from the digester would be washed in pits and from now on treated as any other pulp for paper-board making, going through beater engine, jordan and board machine.

Experts who have examined this prospective system point out a number of defects. It would be very difficult or impossible to pick from a moving belt conveyor all of the non-fibrous materials in the garbage. Only a minor portion of the grease would be extracted by merely cooking and skimming the waste water. Discharging odors into the boiler firebox would not completely destroy them. These difficulties might be overcome by modifications of the system, but it still remains doubtful whether this source of pulp could compete at this time with our still abundant supplies of wood pulp, although as our natural supply diminishes garbage may become an increasingly important source of paper and paper-board pulp.

Another San Francisco concern has attacked the garbage disposal problem with the idea of obtaining from this civic waste a cellulose product, moludite, which is used as a dressing for fabrics and paper, as a binder for fuel briquettes and for other uses. Says one of the officials of this company:

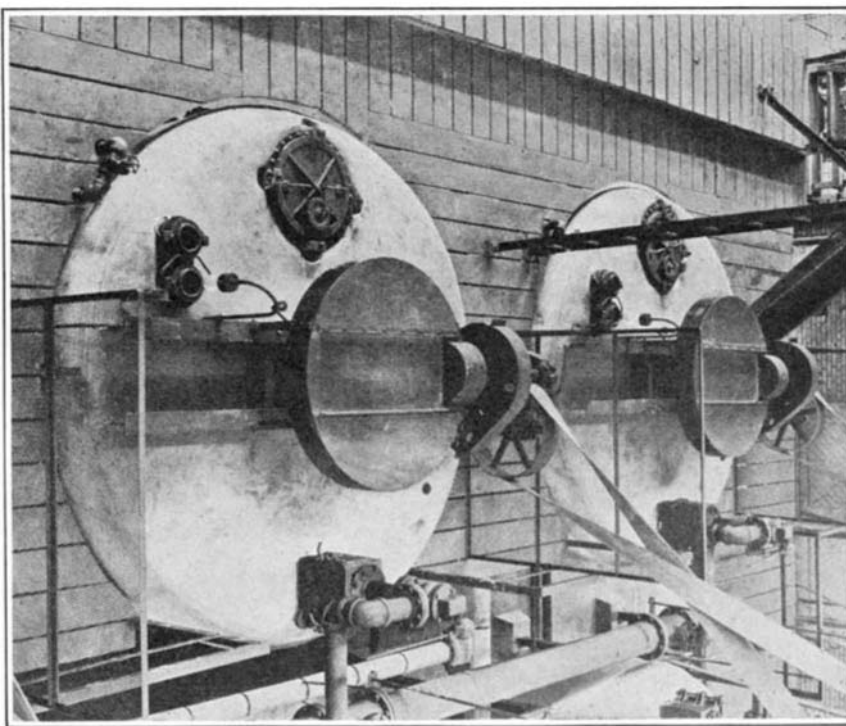
"One of our processes for obtaining moludite is that produced by ordinary garbage or swill. When we found that we could briquette coal from the moludite obtained from city garbage, it then became a problem for us to work out some satisfactory method of reducing city garbage in large quantity for what was then the sole purpose of obtaining the moludite. We have had specialty engineers at work and feel that we are now about ready to complete a process for the reduction of city garbage, which will do away with fumes, odor, incineration or cooking. It is a simple method and from our research work we are beginning to feel rather elated at our success and expect in the near future to be able to demonstrate a complete unit in operation."

Another claimant for the honor of having successfully solved the problem of garbage disposal is a Washington, D. C., inventor, who proposes to produce a fuel by mixing garbage along with street sweepings and other civic wastes with coal dust, pitch and creosote. It is argued that the civic wastes and coal dust, which is now a waste product at the mines, are now unused materials and that the resultant fuel, in addition to being economical, is equal to the best coal in fuel value, is clean, sootless, clinkerless, odorless, nearly smokeless, and non-coking. It is difficult to see, however, how any value is added to the fuel by the addition of wet garbage. But even if this material can be profitably used, the large amount of coal dust required (45 per cent. of the total fuel tonnage) would restrict the usefulness



Part of an experimental plant in San Francisco, where cardboard has been produced from city garbage

and that disposal stations can be placed about the city so as to effect economy in the collection of the garbage. They say the system is odorless, that no expert labor is required, no power, no careful manipulation. On the other hand, there is the obvious disadvantage that, because of the long time the garbage must remain in the tanks, a very large number of tanks would be required to care for a city of any considerable size, and



Top view of Cobwell digesters

these would, of necessity, occupy large plots of valuable ground.

No attempt is made, under this system, to recover from the garbage any of the values it contains, excepting fertilizer. A San Francisco inventor, however, believes he can make cardboard from garbage at a profit, and has erected an experimental plant where he has turned out small quantities of cardboard, using garbage as a raw material. The process of utilization which

of the system to a few cities in or near mining districts. The product would naturally have less value in these regions than elsewhere, and furthermore the plant would have to turn out about double the quantity of fuel in summer as in winter, to prevent an accumulation of garbage. A plant for the utilization of this process has been under construction at Sandusky, Ohio, for about two years, but has never been placed in operation, and no large-scale test has been made. However, a number of stock companies have been organized to exploit the process.

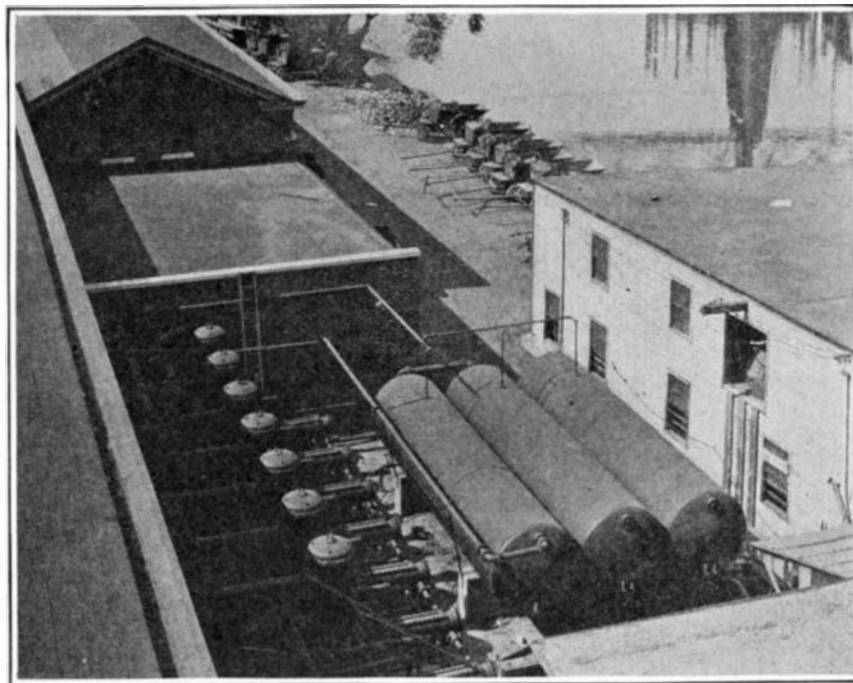
The fifth of the new schemes is destructive distillation, proposed by a New York inventor, and it, like some of the others, has the weakness that it has never been tried on a commercial scale. It is proposed, here, to seal the wet garbage in large retorts and to subject it there to a high degree of heat, sufficient to gasify and drive off the vegetable and mineral oils and many of the chemical constituents. This complex gas goes to a "scrubbing" chamber where it passes through a fine water spray, causing the valuable elements to be precipitated in liquid form. It is claimed there can be recovered in this way not only the vegetable greases, but valuable mineral oils and a long list of chemicals, and, in addition, there will remain a gas which can be used under the retorts. Thus the system provides that the garbage destroys itself, after only an initial heating. If it is found that this cycle is really practicable, the fuel economy will be a powerful point in favor of the proposed system.

Of greater interest, perhaps, from the practical standpoint of the city official faced with a garbage disposal problem which waits neither on science nor finance, is the development of a device reported briefly in our former article. This was the discovery by Dr. Yandell Henderson of Yale that odors which could be passed through a stack, or otherwise confined for a short time, could be "gassed" and completely destroyed. The active agent is the greenish vapor, chlorine, with which the Germans introduced chemical warfare.

This new development has been a modification of the Cobwell process of garbage reduction, to make it more economical. This process, which is a development of the past few years, meets in an ideal way all of the requirements of a good reduction process, excepting perhaps the matter of cost. The process is sanitary, odorless and it recovers the grease and fertilizer values in their best form.

We related in the former article how the garbage reduction plant at New Bedford, Mass., in an attempt to reduce its costs, had used garbage tankage as fuel under the boilers and that odor from such burning caused the scheme to be quickly abandoned, so far as this particular detail is concerned.

At New Bedford the Cobwell system is used. In this process the garbage is dumped into reducers and this is covered with a solvent, gasoline. The reducer is steam-jacketed and by means of steam heat the gasoline and water in the garbage is slowly boiled away. This step dehydrates the garbage, releases the grease and at the same time renders the material sterile and inoffensive, the full period of operation requiring from 12 to 18 hours. After the cooking or dehydrating period the supply of steam in the jacket is cut off and the remaining solvent, which carries the grease, is withdrawn through a strainer in the bottom of the tank. The mass is then flushed two or three times with fresh solvent to remove any remaining grease. The steam is then turned on again to heat the tankage and drive off in the form of vapor the remaining solvent. The brownish granular mass that remains is withdrawn through a door in the side of the tank and is ground for use as fertilizer. The solvent carrying the grease is piped to stills, where the solvent



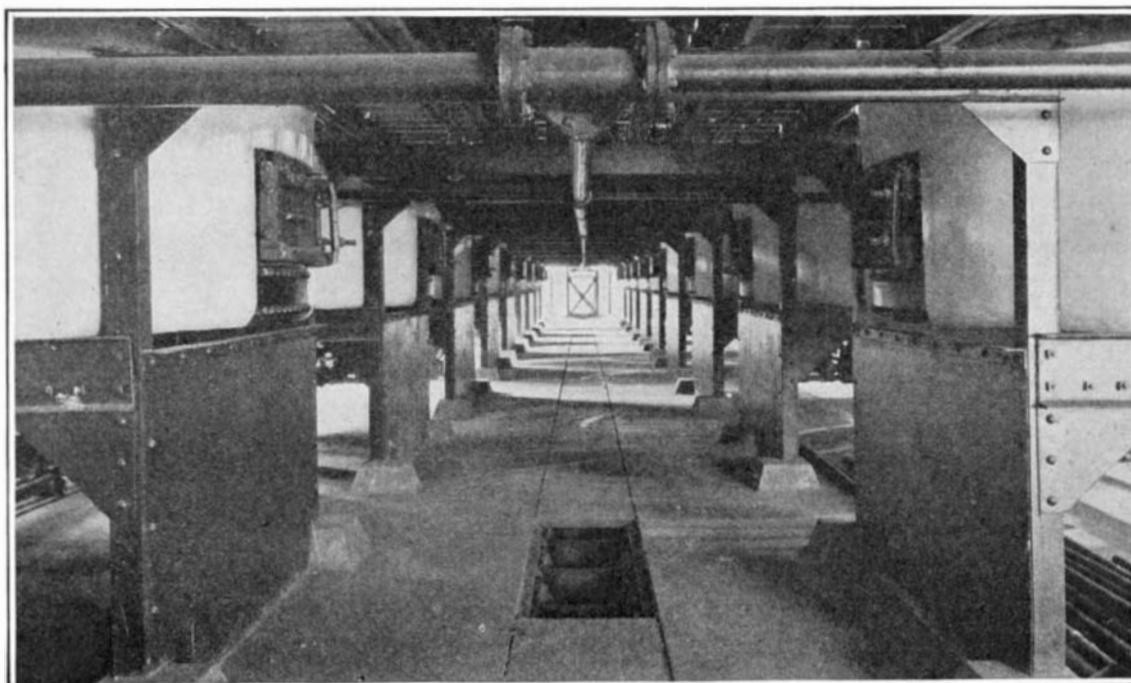
Condensers and solvent storage tanks of a typical Cobwell garbage-reduction plant

is evaporated by steam heat and only the grease remains.

The solvent vapors in each case pass through condensers and then flow back to storage tanks in a liquid state. But notwithstanding the greatest care an appreciable amount of the solvent is lost. It was believed that if the time of dehydration could be reduced, less solvent would be lost and less power used. Having been assured that the obnoxious odors from the drying of garbage could be destroyed by the use of chlorine gas, the New Bedford city officials purchased and had installed a direct-heat rotary-type dryer and this is now used to evaporate the bulk of the moisture contained in the raw garbage before it is put into the Cobwell reducers. This has resulted in reducing the cooking or dehydration period to three hours, at once greatly reducing the solvent loss and fuel consumption and doubling the capacity of the plant, without increasing the labor required or the loss of by-products to be recovered.

The use of direct-heat rotary dryers for the drying of garbage is not new and was known to be economical, but was practically abandoned years ago because of the offensive odors generated by heating the material to high temperatures. In the case of New Bedford, the vapors or odor-bearing gases are passed through a mixing chamber where they come in contact with the chlorine gas injected by the Henderson-Haggard deodorizing process, and when discharged into the atmosphere no noticeable odor is present.

It has been suggested that this experience will be of value to many cities which have outgrown garbage disposal plants of this general type, as well as to cities operating such plants at an excessive cost.



The reducer room of a large garbage-treating plant

The Nature of Soil Fertility

THE problem of maintaining the fertility of our richer agricultural soils and of improving that of the poorer ones is one of ever-increasing importance. Soil fertility, however, is often spoken of as though it were an absolute property of a soil: it is not always sufficiently emphasized that fertility is a particular relationship subsisting between *soil conditions* on the one hand and *crop growth* on the other. The particular conditions that conduce to soil fertility are the resultant of two main groups of factors: the *intrinsic* properties of the soil, which are dependent on the actual chemical and physical and biological nature of the soil complex; and those *extrinsic* properties which are impressed on the soil by topographical and climatic factors. These two groups cannot be sharply distinguished from each other, nor can any hard and fast line be drawn between the various chemical, physical and biological factors comprised in them because few are at present susceptible of any exact measurement. In other words, that particular group of conditions that make up the fertility of any particular soil is an *equilibrium* caused by the interactions of numerous factors, some of which can be varied by the agriculturist by manurial and cultivation operations. It is

by these operations (knowledge of which has been evolved empirically throughout the ages) that the farmer is enabled to maintain or to change, or to regulate and adjust the relationships between soil conditions and crop growth.

Among those soil factors that are most readily susceptible of regulation and adjustment are many that cannot be allowed to vary beyond comparatively narrow limits without becoming limiting or controlling factors in crop production. The capacity of the soil to supply the necessary nutrients for plant growth is of fundamental and obvious importance; the original reserve of foodstuffs, supplemented by biological activity of the soil organisms, is insufficient, and must be aided by addition of natural or artificial fertilizers. The complexity of even a single factor such as this is evident when it is remembered that the very poorest of soils apparently contains sufficient nutrient material for many hundreds of crops, and the rate at which the potential foodstuff is made available for the plant is apparently of more importance than the actual amount of nutrient material present. The micro-organic population of the soil is also of supreme importance, and not merely as food producers, although the conditions governing the equilibrium between the various genera and species form an almost untouched field of work. The relation of the soil to air, water, and temperature forms another group of limiting factors of no less interest and importance than the others. All these and many more are intimately related and mutually dependent—the simple addition of a few cwts. of soluble fertilizer means far more than a mere trifling addition to the store of plant food in the soil, for such an addition is followed by an alteration in many physical and biological properties of the soil.

Anything that produces an alteration in any of these numerous and mutually dependent factors will have its effect also on many of the others, and the complex system of equilibria existing or tending to exist in the soil will be disturbed. In particular the growth of soil organisms, as well as that of the plant itself, is very sensitive to the reaction of the medium, and it frequently happens that the presence or absence of a base will act as a limiting factor in crop production not merely through the effect of acidity or alkalinity on the plant itself, or on the soil organisms, but on account also of the varying displacements produced on all the elaborately inter-related factors that go to make up the complex chain of soil equilibria.