MAKING MONEY OUT OF WASTE.

USING THINGS THAT WERE ONCE THROWN AWAY.

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One of the most interesting phases of the world's development is the manner in which the people of civilized nations are utilizing so many things which were only recently considered as valueless—to be thrown away as worthless; while what we have thought was useless stuff, merely fit to be trod under the feet as so much dirt, has been converted into a product of great value. The increase in the population of various countries, and especially the increase in the number of inhabitants of great cities, has been one of the reasons why the genius of the inventor has contrived to make what we have called waste of worth to us by using it in various compounds and articles which have already become indispensable. The things that are thrown into the street, house yard, and other receptacles for debris can be used in so many ways, that scarcely anything can now be considered refuse. For instance, old tin cans are melted to be molded into buttons, covers for luggage, and toys for children, which sell throughout the world at Christmas time. Discarded shoes and rubbers, also scraps of leather, have become of value in manufacturing various substances. Not a single bottle or other piece of glass need be thrown away, for mixed with certain kinds of earth and sand, it makes an excellent artificial stone for buildings. Not so long ago dead animals were buried, as it was not known that their bones, hide, and even parts of the intestines were of use. Much of the inflammable composition in the lucifer match is now obtained from such bones. Even the sweepings of the street pavement, containing as they do particles of horseshoes and other metal, are worth gathering; while the bits which fall from the horse's hoof as it is being shod by the farrier make a most valuable dye when mixed with certain chemicals and metal scraps.

Over nearly every large city, especially such centers as London, Birmingham, and seats of other great countries, are enormous clouds of smoke, which so frequently darken the atmosphere that even at noontime it is necessary to have lights in the buildings. Yet this smoke if properly treated can be actually dissolved into several most useful elements—and the inventor has designed apparatus by which these elements can be secured at a small cost. It is a fact that smoke can be weighed and measured like so much earth and sand. Experiments which have been made in the United States show that a cord of ordinary fuel wood in burning generates 28,000 cubic feet of smoke. If the smoke from 100 cords of wood is treated by this process, it will yield no less than six tons of the valuable chemical known as acetate of lime, besides 25 pounds of tar. But the smoke contains so much of the element of alcohol, that this quantity will produce no less than 200 gallons of spirit suitable for lighting, heating, or the operation of motors.

Usually perfumes and other useful odors are considered as being obtained principally from flowers. The oils coming from waste fruit, such as decayed pears, grapes, and peaches, however, can be substituted for some of the most costly floral odors after being treated with acids and other liquids which give them a remarkable fragrance. Perfume, soaps, even confectionery, are now manufactured, which are flavored with what is called the oil of bitter almonds, but which is extracted from the tar which is a refuse of gas-making plants such as are to be found in every large city.

The enormous production of iron and steel in various forms has caused great furnaces to be erected for smelting this metal in large quantities. Here again a study has been made of what can be done to use what was formerly waste. Even the gas which in the past has been allowed to escape in the air has been made prisoner, so to speak, and converted into a most valuable factor. The mixture left after the iron has been extracted from the ore—sometimes called slag—which represents the debris of the iron ore, is now one of the most valuable compounds coming from the blast furnace, although but a few years ago it was thrown away. In fact, blast furnaces have been built on the edge of swamps and bodies of water, so that the slag could be thrown into these places and used for filling them up. Very good glass is now made from this slag, as well as paving blocks and bricks, artificial porphyry, and a cement which is equal to the best. Ground with six per cent of slaked lime, building mortar is also made from slag; and ornamental copings and moldings, window sills, and chimney pieces are fashioned of it.

Slag brick is stated to be quite as strong as ordinary brick, and much less permeable to moisture. To make 1,000 brick, 6,000 or 7,000 pounds of granulated slag, and from 500 to 700 pounds of burned lime, are consumed. Good bricks also can be made from granulated slag mixed with dust from slag, though the hardening process is rather slow. Slag is also used for steampipe and boiler wrappings, in which form it is called "silicate of cotton." Coal slag is a good structural material; mixed with slaked lime, it stiffens into a mass weighing from fifty to one hundred pounds per square inch. Basic slag is used in large quantities by manufacturers of fertilizers, instead of phosphate rock.

The greatest metal industry in the world, which is now being built in Indiana, forming an entire city in itself, is provided with iron smelters from which the gas as it rises will be returned to the fires beneath the ore and used for heat. By this system the cost of coal to smelt the ore will be about one-half the expense if the gas were not secured as stated. Waste gas has been utilized by inventors for the direct operation of engines so large that they have a force equal to the power of a thousand horses. As it issues from the smelter, the gas enters a large cover, as it might be termed, placed above the furnace. In the center of the cover is a pipe, through which the gas passes into a reservoir below. From this it is forced directly into the engine, and ignited by an electric spark. This causes it to explode, and the force of the explosion drives the engines and the other machinery.

One of the most important discoveries which has been made in connection with what we have called waste products is the value of sawdust. Usually sawmills produce such large quantities of the material, that it cannot be burned to advantage. It is then thrown away, so to speak, sometimes being piled in great heaps and left to slowly consume. A very good quality of alcohol, however, can be distilled from ordinary sawdust by an inexpensive process, in such quantities that two gallons of the liquid can be obtained from 220 pounds of dust. The sawdust from birch and some other species of forest trees will also yield a palatable sugar after it has been treated with certain chemicals. In America and in some parts of Europe an enormous quantity of the dust is sold, being vended about in wagons and in sacks carried on the backs of the vendors. It is bought to sprinkle on the floors of cafés, butcher shops, and other places where it will prevent dirt from sticking to the floors. In recent years so many dolls and other "stuffed" toys have been made, that the sawdust is used very extensively for this purpose also. It is a fact that there are five hundred sawdust merchants in the city of New York alone, and that they sell what is generally called waste to the value of 400,000 pounds in a single year.

Since the slaughter of cattle, sheep, and other animals on a large scale was begun at the abattoirs in America, France, and other countries, the valuable articles and compounds which have been made from dead animals is really amazing. In some of the American abattoirs the carcass of a single beef may enter into no less than four hundred different articles, ranging from the beef steak for the family table to the buttons sewed on the family clothing. Parts of the animals formerly discarded go into medicines, oils, soaps, brushes and combs, mirrors, household necessaries such as handles for tools, leather for harness and luggage covers. Even the teeth are fashioned into studs and buttons. A list of the slaughter-house by-products which are now utilized for commercial purposes includes hair, bristles, blood, bones, horns, hoofs, glands, and membranes—from which are obtained pepsin, thymus, thyroids, pancreatin, parotid substances, and suprarenal capsules—gelatin, glue, fertilizers, hides, skins, wool, intestines, neat's foot oil, soap stock, glycerin from tallow, brewer's isinglass, and albumen. Albumen is obtained from the blood of the slaughtered animals, and is used by calico printers, tanners, sugar refiners, and others. The bones coming from cooked meat are boiled, and the fat and gelatin which result are used, the former to make soap, the latter for transparent coverings for chemical preparations, and for other purposes. The uncooked bones are used in a variety of ways. From the bones of the feet of cattle are made the handles of tooth brushes and knives, chessmen, and nearly every article for which ivory is suitable. Combs, the backs of brushes, and large buttons are made from horns, which are split and rolled flat by heat and pressure.

Hoofs are utilized according to their color. White hoofs are exported largely to Japan, to be made into various ornaments and imported back as "Japanese art objects." From striped hoofs buttons and horn ornaments are made; while black hoofs find service in the manufacture of cyanide of potassium for the extraction of gold, and are also ground up as fertilizer. From the feet neat's foot oil is extracted, and from various other portions of the body various other oils, all of which are highly valuable. Substitutes for butter, such as butterine and oleomargarine, are made by utilizing the fat of beef and hogs.

In the textile industry the making of value out of waste has been truly remarkable. In the modern woolen factory no fewer than five products are obtained by methods now in vogue, from the greasy excretions which, after circulating through the animal's system, attach to the wool of a sheep. These products are used as a base for ointments and toilet preparations, for dressings for leather, as a lubricant for wool and other animal fibers, and in conjunction with certain lubricating oils. At one large plant in America more than 200,000 pounds of wool are "degreased" every ten hours. From two million to three million dollars' worth of wool fat and potash are estimated to have been wasted during a year in the United States before the solvent process of extraction came into general use.

In the industries of cotton manufacturing and cottonseed oil making, scarcely anything is allowed to go to waste. For many years the seed of the cotton plant was regarded as without value; now the cottonseed crop of the United States is worth about one-fifth of the total cotton crop of the country. Among the principal uses of cottonseed oil are its part in making lard compound and white cottolene, both valuable food products. Cottonseed oil is also used as a substitute for olive oil, by soapmakers in the making of soap, by bakers, and also in the manufacture of washing powders.

The leather industry is equally saving in the matter of wastes. In the tanning of leather, there are developed as side products scrap and skin, from which glue is made; hair, from which cheap blankets and cloths are manufactured, and waste liquors containing lime salts. By means of a special apparatus scraps of leather are converted into boot and shoe heels, inner soles, etc. What is called "shoddy" leather is made by grinding the bits of leather to a pulp, and then by maceration and pressure forming them into solid strips.

But perhaps the most wonderful way in which what we have called ordinary dirt has been made a most valuable agent is in the making of concrete. It is needless to say that what is really concrete all comes from the ground. Even the cement lies in deposits here and there in the earth, and is made ready for use by a very simple process. Mixed with sand which is to be found so abundantly, then combined with crushed stone or gravel, it is only necessary to pour a little water over the compound to create the liquid stone with which the builders are performing such marvelous exploits. Concrete is not only being fashioned into great bridges and monuments, but is being molded into enormous hotels and other buildings, which in America are called "skyscrapers." It forms the linings of huge tunnels and sewers, it is so massive and solid that it is used for great foundation blocks, yet in every case it is a mixture of four of the most common elements known to us—sand, cement, stone, and water.

The advantages of small electrically-driven refrigerating plants were recently discussed before the Franklin Institute. One rather interesting plant described was set up in a florist's shop. A large display case embracing about 500 cubic feet was refrigerated by means of from 500 to 700 pounds of ice per day, this large amount being required by reason of the fact that the case was frequently opened during the day. A small electrical refrigerating machine of one ton capacity has now been erected, and this serves to freeze a solution of brine contained in four tanks. The brine solution is very weak, and has a freezing point of about 26 deg. Fah. The tanks are frozen solid each morning, and the machine is not operated again until toward evening. The system has been found to work admirably even though the door is constantly opened and the temperature may rise at times as high as 60 deg.