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SCIENCE AND COMMERCE AS PEACEMAKERS.

There are two and only two great interests which, in the progress of mankind toward civilization, have proved themselves to be overwhelmingly on the side of peace, namely, Commerce and Science. And to the development of these we must look for the final suspension of warfare, if the reign of universal peace shall ever dawn upon earth. It is true that religion claims to be a peacemaker also—the great peacemaker; but history shows it to be rather a stirrer up of strife. It is not until men cease to regard religion as the first of human interests, not until they become comparatively indifferent toward it indeed, that they cease to fight about it.

The influence of commerce as a preventive of war is more direct and tangible. To the commercial mind the leading question touching any course of action is, Will it pay? And the experience of mankind is, on the whole, that, commercially considered, war does not pay. Particularly is this true when the commercial relations of the contestants are at all close. Besides, commerce makes for peace by multiplying channels of friendly intercourse, by removing national prejudices, and by increasing the mutual interdependence of nations.

The peace promoting influence of commerce can be clearly seen in the recent history of the relations of this country with England. We have had disputes in abundance, and, according to non-commercial standards, plenty of occasions for an appeal to arms. But our commercial relations have been so intimate and extensive that we could not afford to go to war; consequently our difficulties have been honorably settled by arbitration or other peaceful means.

It is equally clear that the commercial interests of England have been the chief restraining force in that country during the recent oriental trouble. Both the ruling class and the rabble have been eager for war; but the prudent, practical, commercial element has carried the day for peace. And we may set it down as an axiom in social science that as the commercial intercourse and mutual dependence of nations increase, their disposition to go to war with each other will decrease. With such nations the prosperity of the people outweighs dynastic pride or imperial ambition. The people say, "War will not pay: let us have none of it;" and more and more in the world the will of the people rules.

As the great ally and mainspring of commerce, science plays an important role as national peacemaker; but its chief influence comes through its service in making war more and more terrible and destructive, on the one hand, and, on the other, in making it less and less a matter of individual heroism and brute force. It is a common remark that the history of military art is simply the record of inventions for enabling men to kill each other with ever increasing ease and swiftness. And the latest inventions have been most marvelous in their capacity for killing. There is small chance for personal glory on the battlefield now; and every new invention only helps to reduce battles more and more to the level of the shambles. The question is, Will not this line of progress soon end in making war too horrible to be tolerated? It must be apparent before long that no end attainable through fighting can be worth the sacrifices necessary to gain it through or in spite of such destructive agencies.

Besides, may it not be possible for inventors to contrive engines of destruction, so awful in their scope and so irresistible in their power, that the mere assembling of masses of men for offensive purposes may be made too hazardous to be attempted?—engines by means of which a city or an army, however protected by fortifications, may be destroyed without possibility of escape?

We have seen of late years how one branch of warfare has been practically suspended by the progress of invention. In their desire to compete with the naval power of England the governments of Europe have for the past quarter century put forth their strongest efforts to bring the science of offensive and defensive naval construction to perfection; and England's counter efforts to maintain the supremacy of her fleet have called out the utmost energies of her inventors and builders. Yet the result seems to be to make a great naval battle no longer a possibility. During the Franco-German war the second best navy in the world could do nothing. During the war just ended the splendid fleet of Turkey, officered by Englishmen, has been little better than useless. And with all our joy at the termination of that conflict, we cannot repress a shadowy regret that no opportunity was offered to remove the uncertainty as to whether the English ships could have got out of the Sea of Marmora if any one had chosen to stop them. It might be worth a small war to have the status of iron clads definitely determined. As things stand their utility is wholly a matter of conjecture.

So much for invention in naval warfare. The torpedo has been the great peacemaker. And it is quite possible that the torpedo system may ultimately perform the same war restraining office on land. Surely science and ingenuity are capable of creating an aërial torpedo boat as efficient as the water torpedoes are. And then, who will dare go to war? Let us imagine an aërial torpedo carrier that could be navigated by electricity from the ground or from another air ship kept beyond the reach of destructive missiles; a deadly machine that could be made to hover over an attacking army or a beleaguered town and rain upon it explosive shells of the most destructive sort. Against a fleet of such engines, what city could stand, what fleet or army could gather for offensive purposes? All the usual machinery of war would be useless, and war as we understand it would be impossible. As the sea torpedo has made an end of naval battles, so the air torpedo would put a stop to battles on land. And just as, through increasing civilization, men are learning more and more to put their trust, not on personal prowess or elaborate armament, for the settlement of their personal disputes, but in courts of law, so nations must learn to submit their quarrels to international courts of arbitration. In perfecting firearms, science put an end to individual dueling. In like manner, by perfecting means of wholesale killing, science is likely to put an end to national dueling. The most efficient agent of the (unorganized) Universal Peace Society of the future will be he who shall invent the best aërial torpedo carrier.

THE UTILIZATION OF WASTE MATTERS.

The strict economy of Nature, which never allows a particle of matter to be either wasted or lost, is so manifest that it could scarcely have escaped the attention of man; and so, when circumstances compel him, it is not surprising to see him putting in practice the lesson she has taught him, and striving to put every scrap to the best account. In China, owing to the crowded state of the population, this economical husbanding of material has, of necessity, long been in vogue; and to such an extent is it carried that what would be considered strict economy in Europe or America, would there be regarded as absolute waste. The same causes have been slowly operating to bring about a similar state of things in Europe. Thousands of materials that were but a few years ago thrown away as utterly useless are now carefully saved and turned to some account either for purposes of luxury or necessity. Hosts of costly products of distant climes can now be procured at home, at an insignificant expense, from the most unpromising sources. For instance, Science has evoked the most delightful perfumes from the most offensive refuse, and extracted dyes of the most gorgeous hues from a most unlikely looking material—pitchy-black tar. Accidental discoveries, no less than active researches, are continually transforming some article comparatively worthless into something else that stands high in commercial estimation, and supplementary factories are gradually springing up to utilize the by-products of others. So numerous are the discoveries that something useless may be converted into something useful, and so rapidly does one follow in the wake of another that it is difficult to keep pace with them. Scarcely a scientific exchange reaches us that does not contain the announcement of some such fact, and the details of the process by which the result may be reached. Here, for example, before us, in the current number of the *Echo Industriel*, we have a description of the method by which the straw is extracted from manure heaps to be subsequently utilized (after cleaning and drying) as a cheap bedding for horses and cattle, packing for glass, crockery, etc., but more especially for making paper pulp, to which it is said to be peculiarly adapted; since, saturated with urine and allowed to ferment, ammonia is evolved, which aids in separating the fibers, and reduces the need of using stronger and costlier alkalies to a minimum. After extracting the straw the remaining manure is sold for the usual purposes. The simple machinery for doing all this is the invention of an American resident of Paris. Much of the false hair worn by the fair sex of Europe and America is derived from sources that would make the wearers stand aghast were they to learn the facts. From a late report on the commerce of Swatow (China) we learn that a large export trade in hair, gathered in the stalls of barbers, sprang up in 1873, during which year 141 piculs (18,800 pounds) worth 2,904 taels ($4,300), were shipped to Europe. In 1875 the exports of this refuse arose to 1,000 piculs, with a value of over $25,000, certainly a remarkable industry to be created at such a distant point to supply the demands of a caprice of fashion.

To chemistry modern perfumery is perhaps more indebted than any art that ministers to the luxury of life. It is commonly supposed that all floral essences are the product of distillation; nothing could be a greater mistake; nearly every perfume of the toilet bottle or sachet of the mouchoir case is the product of waste matters—some of them odorless, others most intensely nauseous and disgusting. "Many a fair maiden damps her brow with the "Extract of Millefleurs," innocent of the knowledge that its essential ingredient is derived from the drainage of the cow-house! The perfumed toilet soap is scented, and confectionery flavored, with oil of bitter almonds artificially prepared by the action of nitric acid on the fetid oil of gas-tar. The pure "fruit sirups" of some of the soda water venders are made from factitious oils that chemists have learned how to produce. Singularly enough, too, the latter are usually derived from substances of disgusting odor. The oil of pine-apples is obtained from a product of the action of putrid cheese on sugar, or by making a soap with butter and distilling it with alcohol and sulphuric acid. The peculiarly fetid substance called "fusel oil" serves as a base for several artificial flavors; thus, distilled with sulphuric acid and acetate of potash it gives oil of pears; with sulphuric acid and bichromate of potash the product is oil of apples. And so, too, by other means known to the chemist, refuse corks are made to yield essence of mulberries, tallow to put forth essence of melons, and the wood of the willow tree to part with oil of wintergreen indistinguishable from the genuine article." The fact, well known to the schoolboy, that by the action of sulphuric acid on starch, sawdust, woody fiber, etc., a sac-

charine substance called "glucose," or grape sugar, is produced, has not by any means been lost sight of in this country, notwithstanding the low price of cane sugar. Extensive works for the manufacture of this article are located in one of the largest cities of the western part of the State, and almost every day one or two car loads arrive, occasionally consigned to Europe, but oftener to the various brewers of the city and vicinity, and to extensive dealers in molasses. All these matters show a direct application of science to an industrial purpose, and imply a knowledge of the deepest investigation into organic chemistry.

One of the most singular discoveries in the history of agricultural chemistry is due wholly to the French. Sheep draw from the land on which they graze a large quantity of potash, which is eventually excreted from the skin along with the sweat. It was shown by Chevreul that this peculiar potash compound ("suint") forms at least one third of the weight of raw merino wool; while it constitutes about 15 per cent of the weight of the fresh fleece. As it is easy to extract the "suint" by mere immersion in water, the wool manufacturers can readily produce more or less concentrated solutions, from which the potash may be recovered by appropriate treatment. The development of this new industry is principally due to MM. Maumné and Rogelet, whose process, in operation at most of the great seats of wool manufacture, is very simple. They evaporate the solutions to dryness, and place the residuum in retorts, and distill it very much the same as coal is distilled at gas works. The result is that while much gas is evolved which can be used for lighting the factory, and much ammonia is expelled which can be collected and used in many ways, there remains a product consisting of carbonate, sulphate, and chloride of potassium. These salts are separated by the usual method and pass into commerce. While on the subject of animal refuse, we may refer to the manner in which certain dead animals are utilized in France. Every portion of a dead dog, for instance, is converted to some use; it is boiled down for the fat, the skin is sold to glovers, and the bones go to make "superphosphate." In Paris the carcass of a horse is worth more than elsewhere, inasmuch as the working classes eat the best portions of the flesh. The hair is a well-known refuse used by the upholsterer; the hide goes to the tanner to make thick leather for bank ledgers, etc.; the intestines make coarse gut-strings for wheel bands and lathes; the fat, which from a well-conditioned horse amounts to 60 lbs., finds a ready market; the hoofs are used either by turners or makers of Prussian blue, and the bones go to manufacturers of ivory black and to turners. Even the putrid flesh is allowed to breed maggots, which are sold as food to fatten fowls. The final residue is used by rat catchers to trap their prey, and the skin of the captured rat finds a ready sale among furriers on account of its delicate fur. A statement that has frequently gone the rounds of the papers to the effect that most of the "kid" gloves of commerce are made from the skin of this rodent is probably untrue, since its small size would preclude its use for anything but gloves for children.

The great meat-packing establishments of the West afford examples of the extreme refinement to which the utilization of by-products may be carried. Not a scrap of the slaughtered animal is wasted. Every portion fit for food (even to the heart and liver) is pickled and packed, and most, if not all, of it exported to Europe. The fat, hoofs, horns, hides, tails, hair, and bones find a ready sale in this market, for various purposes in the industrial arts; and the final products usually reach us in the form of dried blood and bone-black, for the use of the sugar refiner and the agriculturist.

Until within comparatively a recent period it had become a serious question as to what use should be made of the slag which is produced in such quantities during the smelting of iron ore; human ingenuity at length solved the problem, and produced from this intractable material a white, flocculent substance known as "mineral wool," which at once found numerous applications in the arts. Within the last few years no industry, perhaps, has made greater strides than that of paper making, both as regards the materials of its manufacture and the applications of the product. Paper wheels for railway cars, paper chimney-pots for dwelling houses, and paper plates and teacups for the temporary use of travelers, must suffice as illustrations.

Of course it would be impossible within the limits of so short an article to refer to any more than a few of the more prominent examples of the use of refuse. We have intentionally omitted very many; but the few that we have given will serve the purpose we have in view of showing to how great an extent civilization is daily adding to the useful products of the world, both by economizing its resources and calling forth new ones by the aid of chemistry.

"CONVICT COMPETITION."

Our workingmen readers are invited to consider the following hypothetical case, bearing on the convict labor question—a problem which has recently been made the subject of sundry exceedingly sympathetic diatribes by those solicitous friends of workingmen, the politicians who compose the Legislature of this misgoverned State. The reader will imagine himself in the disagreeable predicament of being assaulted, badly injured, and robbed by a burglar who is subsequently captured, convicted, and sent to prison for a long term. The victim after a long and costly illness finds his savings swept away, and himself maimed and unable to perform his previous amount of work. Still by owning his house he is able to live and support his family. In due time the yearly tax on his house falls due, and in looking over the items of taxation he finds one for "maintenance of prisons and penitentiaries." He goes to a political friend—a legislator—for explanation, and is informed that the average cost of supporting each convict is in the neighborhood of $150 a year, and the people "of course" pay it.

"And what do the convicts do in return?" he asks.

"Nothing. They are not permitted to work at any remunerative industry."

"But while honest men outside are doing severe labor—laying pavements, blasting rocks, erecting buildings, all kinds of hard physical work—how are these scamps employed?

"Well, they eat, and recline in their cells, and read tracts and other interesting literature supplied by philanthropic visitors. Their food is much better than the average workingman has who labors for a dollar a day, and its forthcoming is not dependent on the chances of employment. Oh, if the State is going to shut them up, of course it's got to feed, house, clothe them, provide medical attendance, brace up their moral characters, and turn them over to the Prison Association when they go out, to be started anew in life, with a new suit of clothes and money in their pocket."

"Nobody takes any such interest in my welfare, and I have committed no crime. On the contrary, it taxes all my energies to obtain house, food, and clothing by unremitting labor, which in these times is even difficult to procure. My capabilities are greatly reduced by an injury inflicted by one of these convicts; yet not only is he freely given as much and more, practically, than I am able to earn, but I am compelled to contribute from my scanty means for his support. Why cannot these men be put to useful labor? Why should they not sweeps the streets, as in Cuba and Spain, or work in the dockyards and on public improvements, as is done in France? Why don't you find some redress for this unjust condition of affairs?"

"Because my constituents won't vote for me again if I favor any measure which they imagine affects their pockets adversely. If we employ convicts at railroad building, on public improvements, and other useful outside work, it is true that the prisons will become self-supporting and remunerative institutions, and that instead of your taxes being increased the same would be reduced through their gains. But 6,000 convicts may compete with as many workingmen, and to conciliate these last we think it best to go on and support the convicts."

"In other words, for the sake of political capital and to favor the notions of a few selfish individuals who have no respect for the rights of others, honest men of all classes are to deprive themselves and their families in order to maintain 6,000 scoundrels in idleness?"

"Precisely."

And with this our friend picks up his crutch and hobbles away, wondering, morality aside, whose position is the most unenviable, his or that of the miscreant who injured him. It is fortunate, however, that in this State, through Superintendent Pillsbury's admirable management of the reformatories, the convict labor problem is being removed from discussion and danger of a wrong solution through legislative buncombe or the intrigues of malcontent workingmen. Some of the largest institutions are already self-supporting, and a few are paying the commonwealth a handsome revenue, through the convicts having been quietly set about remunerative work, without regard to the advice of either politicians or demagogues.

STERILIZATION BY LIGHT.

It is hardly necessary to refer to the very highly beneficial influence exerted by light upon health, whether in the animal or vegetable world. Deprivation of sunshine works a retardation, and in many instances stoppage of natural processes. Those workmen are the least healthy who labor in cellars and dark rooms; and it is well known, on the other hand, that light, in greater or less degree, is not without direct influence upon the nervous system. What the mechanical action of light is, however, upon organisms is a problem still unsolved, but that a solution is being approached may be safely predicated upon recent important discoveries. Of these one of the most remarkable is that made by Dr. Downes and Mr. Blunt, and lately described by them in a paper read before the Royal Society, this discovery being that solutions otherwise fertile may be completely and permanently sterilized by the action of light alone.

The fact has been very simply demonstrated by filling test tubes with Pasteur's solution, placing all under precisely the same conditions, and then protecting some from the light by a sheet lead casing. In the protected tubes, the liquid in a few days became turbid and filled with bacteria; the solution in the exposed tubes remained perfectly clear, and no organisms were perceptible under the microscope. This experiment was repeated numerous times, always with like results. The greater the amount of sunshine the greater the sterilizing effect, and a few days of full sunshine were sufficient to prevent entirely the development of the organisms. Tests were instituted to determine if the action of the light resided in the liquid yielding negative results. It was found that light was directly capable of destroying bacteria; as, if a tube was protected from subsequent contamination, it remained permanently sterile after exposure to sunlight, even though subsequently darkened. By other careful experiments it was determined that less than two hours of direct sunlight is insufficient to prevent the development of bacteria in inoculated solutions. The putrefactive tendency of warmth does not override the preservative quality of light; and the experimenters found that, with a full amount of sunlight, tubes could be preserved from day to day as readily in hot weather as in cold.

The action of light was not confined to Pasteur's solution, as urine could be preserved in the same way. It is curious to note that the germicidal influence does not extend to the spores of the yeast plant, and that the light does not retard the growth of the same, there even appearing to be a kind of antagonism between the bacterial and fungoid growths. A series of experiments was instituted to determine the effect of different colored light on the solutions, colored glass screens being interposed. It was found that bacteria appeared first in those protected by yellow, and in those almost as soon as when cased in red; next in the red; while those in the blue remained permanently clear. It is difficult to draw any deduction safely from this. The *Lancet* thinks that it points to the actinic rays of the spectrum as the active sterilizing agents, a view in which we cannot agree, inasmuch as blue glass does not transmit the pure blue spectral ray or even the actinic rays only, but allows rays of all colors to pass, with some diminished in intensity. It acts, therefore, merely as a screen to diminish the power of the light, and the fact that it does so transmit only modified sunlight is indicated by the sterilization produced. Still it is difficult to explain the presence of bacteria under the yellow and red lights, and hence our belief that the correct deduction from this experiment is yet to be made.

One of the most remarkable discoveries of this highly important chain was that in the absence of an atmosphere around the tubes, light exercised no sterilizing influence whatever. Specimens of the same urine, insolated to the same degree, but preserved in vacuo, became turbid from bacteria as rapidly as others incased in lead. The investigators suggest that "many of the related conditions of organic beings may derive new meanings from the facts now ascertained, and point out the apparent antagonism in origin and effect between the colored chlorophyl, which owes its origin to light and is deoxidizing in its action, and the colorless protoplasm which it shields, and to which apparently, at least in some of its forms, the solar rays are not only non-essential, but devitalizing and injurious."

These experiments may be regarded as all the more striking when brought into comparison with some of M. Pasteur's later discoveries. Not long ago he held a discussion with M. Boussingault on the question of the influence of solar radiation, the latter holding that, if solar radiation should disappear, life would be impossible. Pasteur, on the other hand, maintained that it would continue in certain inferior plants, and occasion the most complete organic growths; and he adduced as an illustration the life of the *Mycoderma aceti*, which may take place in darkness on a liquid composed of alcohol, acetic acid, and mineral phosphates. It will be observed that Pasteur's demonstrations that oxygen and light are not necessary to life are remarkably corroborated in these latest researches of the English biologists. Not only may organisms live in darkness, but light becomes an absolute source of destruction to them; not only may they exist without oxygen, but a vacuum forms for them an efficient protection—two conclusions as flatly contradictory as possible to preconceived notions regarding the omnipresent necessity for oxygen and light on the part of all organic nature.

A DANGEROUS ITEM.

We do not remember in what journal we first saw the following extract as an *original* item; but, since it has recently been copied without comment by several cotemporaries, attention should be directed to it. The article states that:

"A poison of any conceivable description and degree of potency, which has been intentionally or accidentally swallowed, may be rendered almost instantly harmless by simply swallowing two gills of sweet oil. An individual with a very strong constitution should take nearly twice this quantity. This oil will most positively neutralize every form of vegetable, animal, or mineral poison with which physicians and chemists are acquainted."

The idea that sweet oil will neutralize such poisons as prussic acid, nicotine, strychnine, curare, and a host of others less speedy in their action, is almost too absurd to demand refutation. In some cases, when taken into the stomach in large quantities, it may serve to involve acrid and poisonous substances and mitigate their action, until the arrival of a physician with specifics shall relieve the patient from danger; but it is not to be used in *all* cases, for its administration, for instance, immediately after the swallowing of a corrosive mineral acid, such as oil of vitriol, would be followed by most fearful results.

As the great multitude of poisons known to the physician and chemist are classified according to their varied mode of action on the animal economy, it is evident that the method of treatment in cases of poisoning must likewise vary. There can be no one specific for all.

It is to be hoped that no one will be simple enough to try this antidote; for if he does, the absurd person who penned the quoted statement may have a human life to answer for.

THE *Société d'Hygiene* of Paris is making arrangements to establish in the cities and towns of France chemical laboratories for the purpose of examining articles of food and detecting adulterations or unhealthful constituents. In England the value of public analysts has long since been satisfactorily demonstrated.