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SIX MONTHS OF SCIENTIFIC PROGRESS.

The scientific and industrial record of another half year is completed with this issue of the SCIENTIFIC AMERICAN. It is believed that no scientific enterprise of popular interest, no notable occurrence, no great industrial undertaking, no important discovery or invention—in short, nothing pertaining to the world's best thought and action during the past six months has failed of timely notice in these pages, while in character and number the illustrations which have given instruction as well as pleasure to our readers are such as to compare favorably not only with those of the preceding volumes of the SCIENTIFIC AMERICAN, but those of any other popular journal ever published.

When Volume XL was begun there still prevailed in many quarters no little doubt and misgiving with regard to the immediate industrial future. The confidence expressed by the SCIENTIFIC AMERICAN in the continued improvement in American industrial affairs has been happily justified; and there is every reason to believe that the prediction that the country was entering upon an era of unexampled prosperity will but feebly express the ultimate fact. The threatened derangement of our manufacturing industries, through the alteration of the patent laws in a way to affect injuriously the rights of inventors and patentees, was fortunately averted, we trust permanently, by the failure of the obnoxious Senate bill 300; and we hope that the public sense of justice and sound policy which frustrated that scheme will prevent a renewal of the attempt next winter.

The steady improvement in the American export trade has been almost as marked a feature of our recent history as the marked improvement in domestic trade. Particularly noticeable has been the outspoken acknowledgment of the superiority of many American products by English and European statesmen and manufacturers, and the frank admission by them that the industrial supremacy of the world lies in the near future with America.

Among the notable improvements in the arts brought forward recently, mention may be made of Barff's process of obtaining a protective coating to iron, Holloway's utilization of the sulphides in ores as fuel, and the new composition for the lining of Bessemer converters, making possible the use therein of phosphorus bearing ores.

The completion of the Sutro Tunnel, the progress on the tunnel of St. Gothard, and the completion of the Joseph II. Mining Adit, are perhaps the most notable achievements in engineering that will occur to our readers. The meeting of the International Interoceanic Canal Congress at Paris promises to mark an important date in the history of man's victories over nature, but its significance can be determined better a dozen years hence.

In pure science there is nothing more important than the investigations of Prof. Crookes with regard to the behavior of electrified molecules in vacuo. His observations are certainly curious, his methods are extremely delicate and skillful, and the results obtained are wonderfully suggestive. What more may come of them the future only can determine.

Among the more important inventions our readers will recall Cowper's writing telegraph and Edison's loud speaking electro-chemical telephone.

Six months ago popular attention was very strongly drawn to the development of the electric light, and something of a panic prevailed among the holders of gas stocks. That flurry has blown over. The electric light has not fulfilled its promises, and Mr. Edison's assertion that his latest lamp is a complete success falls on indifferent ears. The world is not so eager for the change as it appeared, and on all sides the disposition is to await developments patiently. Possibly after all the "light of the future," suggested by the SCIENTIFIC AMERICAN several years ago, and recently worked out practically by Molera and Cebrian, may prove the final solution of the problem.

Among the false lights of the immediate past mention may be made of the extremely confident but suddenly extinguished pretensions of the Hosmer and Gary motors. Instead of revolutionizing the industries of the world by force self-generated, they have dropped out of sight with the thousand other motors of the impossible sort. To which class we may properly add also Mr. Keeley's machine for the utilization of "inter-molecular etheric substance."

In this hasty glance at the salient features of the work of the past six months notice may be taken of two or three which we are confident have added not a little to the interest and value of the SCIENTIFIC AMERICAN. These are the series of illustrated articles on our leading industries; the papers on amateur mechanics, with their practical suggestions and numerous illustrations; and the specially admirable illustrations of natural history. Nothing finer than the last have ever been given in a popular periodical. It is perhaps needless to add that the constant aim of the publishers of the SCIENTIFIC AMERICAN is and will be to make this paper, so far as practicable, a perfect and impartial record of scientific and industrial progress the world over.

CITRIC ACID—FROM THE LIME AND LEMON.

The source of profit in the cultivation of the lime and lemon, which we have recently had occasion to point out (p. 339), has evidently attracted the attention of many of our southern fruit growers, judging from the number of communications and inquiries we have since received respecting the industry.

For the benefit of those interested in the matter we give

the following outlines of the process for obtaining the citric acid from these fruits:

After removing the seeds and peel, the fruit is subjected to strong pressure—a good cider press answers very well on a small scale. The expressed juice is then evaporated in copper or leaden pans (porcelain enameled iron vessels would be less objectionable) at a temperature not exceeding 150° Fah. until it has a density of about 1.23, when it is a dark, thin sirupy liquid containing from 27 to 32 per cent of citric acid.

An instrument termed a *citrometer* is sometimes used to measure the amount of citric acid in the fluid, but the method cannot be relied on, owing to the variable amount of saccharine and other matters present and to the fact that a small portion of the acid is almost invariably decomposed during the concentration. The concentrated juice usually comes into market in casks containing about one hundred gallons.

To obtain the citric acid from the juice it is first clarified by filtration, heated to about 200° Fah. in a lead lined vat, by means of steam circulating in a coil of leaden pipe arranged around the inner side of the vessel. Powdered whiting (lime carbonate, chalk) is then gradually added until the acid is fully saturated, a point readily determined by its ceasing to effervesce. The whiting must be added in small quantities, suitable to the amount of liquor under treatment, and the mixture kept constantly agitated by machinery until the whole of the acid present is converted into insoluble calcium citrate. The mixture is then allowed to settle, after which the supernatant liquid is drawn off and the residue repeatedly washed with warm water, by decantation, the agitating apparatus being set in motion after each addition of fresh water.

The washed citrate is then transferred to a similar vessel, where it is agitated with hot dilute sulphuric acid in the proportion of about 9½ parts of strong acid diluted with six times its weight of water, to every 10 parts of whiting previously used. By this treatment the calcium citrate is decomposed, sulphate of lime and free citric acid being formed. The mixture is drawn off into a settling tank in which the heavy sulphate subsides, while the clear solution of citric acid is drawn off into lead lined vacuum pans, where it is concentrated by steam heat. The concentrated solution of citric acid is then passed through canvas bag filters usually containing a small quantity of boneblack, previously freed from phosphate of lime by dilute hydrochloric acid. The filtrate runs into crystallizing pans placed beneath, in which it stands until the crystals cease to form.

The mother liquors are run back into the crystallizing pan, and the crystals are dried in a centrifugal machine, or by other suitable means.

The article thus obtained is sufficiently pure for ordinary purposes, and represents the citric acid of commerce.

It is largely used by the dye calico printer as a "resistant" for iron and alumina mordants. When required for other purposes it is necessary to purify it by recrystallization.

Citric acid to be used for medicinal purposes or for effervescing drinks, etc., should be prepared in vessels of earthenware, porcelain, or porcelain-enameled iron, as it is apt to contain traces of lead if prepared in leaden vessels.

THE TIDE WATER OIL PIPE LINE COMPLETED.

The first flow of oil from the Bradford oil district reached Williamsport, Pa., June 4. Only a few trifling leaks have been discovered in the entire length of the pipe, or over a hundred miles. The line starts at Williamsport and runs slightly north of west over the mountains into Potter county and on to Coryville, or Frisbie, the initial point, in McKean. It passes over a high range of mountains near the village of Waterville, at the forks of Pine creek, where great difficulties were overcome in laying the pipe.

There are tanks at Coryville and a pumping station. The next pumping station is at a point about four miles from Coudersport, where tanks have been put up and buildings erected for the engine, etc. The distance from Coryville to pump station No. 2 is 22½ miles; from there to Williamsport is 77½, and the oil when raised 1,200 feet at the summit, runs down to Williamsport of its own gravity, as the fall is 2,100 feet. The pumping engines are forty horse power each, and each has an equal share of the lifting to do in the way of the application of power. The pipe is six inches in diameter, and required 28,000 barrels of oil to fill it. At Williamsport receiving tanks holding nearly 60,000 barrels had been provided, and seventy oil cars were in readiness to transport the first flow of oil over the Reading railroad. The capacity of the pipe line is about 6,000 barrels per day, and if everything works according to the anticipations of the company, it may become necessary before the close of the season to build another line.

IMPROVEMENT IN SUGAR MANUFACTURE.

A sugar planter and manufacturer sends to the *Martinique Bienpublic* an account of an experimental application to sugar cane of the diffusion process employed in the beet sugar factories of France and Germany. The experiments were made at the plantation Moncepos, Guadaloupe, with an apparatus of six macerators. It was badly adapted to meet the difficulties incident to the peculiar nature of cane, yet it showed (1) that by a methodical washing of the slices of cane an artificial juice nearly equal in density to natural cane juice could be obtained; and (2) that one hour of systematic maceration is sufficient to completely exhaust the cane fiber of the sugar with it contains.

The yield of sugar in these experiments was from 12½ to 13 per cent of the weight of the cane, in white sugar.

A comparison of the diffusion process, imperfectly carried out, with other processes, shows as follows:

Extraction by rollers, as still practiced on a great number of plantations, obtains:

Raw sugar, crystallized	65
(or 65-180, equal to 36 per cent of total sugar contained in cane.)	
Sugar in the state of molasses	25
Sugar lost in the bagasse	90
	180

By perfected roller mills:

Sugar obtained, crystallized	108
(or 108-180, equal to 60 per cent of the total sugar contained in the cane.)	
Sugar in the state of molasses	32
Sugar lost in the bagasse	40
	180

By the diffusion process:

Sugar obtained white, crystallized	130
(or 130-180, equal to 72 per cent of the total sugar contained in the cane.)	
Sugar in the state of molasses	40
Losses	10
	180

The advantages realized by diffusion can therefore be summed up as follows:

Over the perfected presses, 72-80, equal to 12 per cent; over the not perfected presses 72-36, equal to 36 per cent. We shall therefore obtain a surplus of 12 to 36 per cent upon the total weight of sugar in the cane; or in other words, the production will be increased one fifth of the sugar obtained in the first case, and in the second case it will be doubled.

The molasses will be of a better quality, being less colored and of a more agreeable taste.

THE BREWERS' CONVENTION.

The nineteenth annual convention of the United States Brewers' Association began in St. Louis, Mo., June 4. This association represents 2,830 breweries, of which New York has 405, Pennsylvania 383, Wisconsin 248, California 213, and Ohio 207.

The sale of beer for the year ending June 30, 1878, was the largest ever known, being 9,473,361 barrels, which was 313,685 barrels more than the next largest in any fiscal year, that ending June 30, 1876. The figures for the first nine months of the present year indicate that fully 10,000,000 barrels will be sold. Of this the breweries of New York produce about a third.

The export trade in American beer is rapidly increasing, a committee report giving the figures as follows:

EXPORT OF BEER OF DOMESTIC PRODUCE.

	—In Bottles.—		—In Casks.—	
	Dozens.	Value.	Gallons.	Value.
1870	1,076	\$2,250	66,467	\$23,759
1874	2,897	6,345	99,135	33,357
1878	76,475	108,379	119,579	38,918

Meantime there has been a remarkable falling off in the importation of beer, as will be seen by the following table:

IMPORTATION OF FOREIGN BEERS INTO THE UNITED STATES.

	Gallons.		Value.	
1875	2,167,351	\$1,742,120		
1876	1,490,150	1,161,467		
1877	974,277	758,850		
1878	767,709	592,707		

THE AUSTRALIAN EXHIBITIONS.

A bill has been passed by Congress authorizing the President to appoint Commissioners to represent the United States at the International Exhibitions at Sydney and Melbourne, Australia, and appropriating \$20,000 for such representation at either or both of them. As the Sydney Exhibition opens in August next this action comes too late to accomplish much there. It is to be hoped that a more generous appropriation may be made for the Melbourne Exhibition, to be held between October 1, 1880, and May 31, 1881. The Australian exhibits at the Centennial Fair were among its most interesting features; and sound commercial policy as well as courtesy warrants something like a corresponding effort to have the United States becomingly presented to the Australians.

THE NEW STEAMSHIP ARIZONA.

The largest merchant steamer afloat, next to the Great Eastern, is the new steamship Arizona, of the Williams & Guion Line, plying between New York and Liverpool. The Arizona was built by Elder & Co., of Glasgow, and is of exceedingly fine model.

She is 465 feet in length, 46 feet beam, 37½ feet depth of hold, and close upon 6,000 tons burden. Her engines are the latest improvement on the compound principle, there being one high and two low pressure cylinders of an indicated horse power of 7,000. She is propelled with a four bladed screw, 23 feet in diameter, with a pitch of 33 feet. The steam is generated by seven double ended boilers, and the consumption of coal is estimated at about one hundred tons per day for full steaming purposes. There are on the main deck five powerful steam winches, with double gearing steam capstan for working the anchor, etc. She is steered from the bridge by steam, and in case of accident is fitted up with the usual manual steering gear in a wheel house, protected by a strong iron turtle back deck. There are also steam pumps and a powerful engine, by which any quantity of water can be brought to any part of the ship in a few seconds. The appointments for the convenience and comfort of passengers are superior, stowage accommodations particularly.

INSECTS AS MEDICINE.

According to our medical exchanges the latest sensation in the way of a materia medica is the *Blatta Orientalis*, or in less scientific language, the cockroach, which comes this time, as it did once before, from Russia. Bogomolow is the name of the person who has investigated it. The beetle, dried and powdered, is given in doses of four and a half grains in Bright's disease, chronic or acute. But it appears that this is not the only thing that the insect is good for, since Unterberger and Kochler are said to have used it with great success in various forms of dropsy.

Kirby and Spence point out the fact that many insects emit very powerful odors, and some produce extraordinary effects upon the human frame, and for this reason, say they, it is an idea not altogether to be rejected that these animals may concentrate into a smaller compass the properties and virtues of the plants upon which they feed, and thus afford medicines more powerful in operation than the plants themselves.

Setting aside the preliminary observation in regard to "powerful odor," such a notion can scarcely have reference to the cockroach, the favorite food of which is the bedbug, or, such pabulum failing, almost anything from a minced pie down to an old boot. What particular medicinal alkaloid the insect's digestive apparatus can eliminate from such a mixed diet it would be difficult to determine. The homœopathic pharmacist, however, has long been accustomed to obtain the concentrated strength of some such active principle by triturating the *blatta* down to its ultimate molecule with sugar of milk. By reference to a homœopathic work on symptomatology we find that "provings" show that this insect, when administered to the healthy subject, causes laziness, which certainly is an extraordinary effect to be produced by so agile a beetle. A high potency of the bedbug is obtained by means of the same manipulation, although the resulting trituration is better known to the followers of the school just mentioned as *Cimex lectularius*. In this comminuted form the bug is found beneficial in fevers of various sorts. But this same delectable insect has also found favor in another practice, used *in puris naturalibus*, and five or six of the bugs being administered for a dose as a cure for chills; and it has likewise enjoyed some notoriety as an emmenagogue. Another insect, not usually mentioned in polite society, also enters into the homœopathic list of remedies, and this is the head louse (*Pediculus capitis*). "Provings" show that this insect has a remarkable cerebral tendency (as we might suppose), and hence its use is indicated in various forms of severe headache, accompanied by nausea and vertigo.

It is curious to look back at the list of *materia medica* of olden times, when, with vipers, toads, etc., insects held a prominent place, and were administered with as much confidence in their remedial effects as is now bestowed on the vegetable and mineral medicines of the present practice. In those days powdered silkworms were esteemed as invaluable remedies for vertigo and convulsions; earwigs were given to strengthen the nerves; and five gnats were equivalent, as a purge, to three grains of calomel. Bees dried and pulverized were believed to cure the falling out of the hair (*Alopecia*), and were also administered internally to promote urine; and for the latter purpose the triturated insects are now used by the homœopaths. These insects, say they, are similar in their action to cantharides, and often succeed when the latter fail. "Still," says the editor of *Hull's Jahr*, "we have often seen them fail in our own and others' hands, when they seemed fully indicated." Again, in the olden time, powdered scorpions were regarded as an infallible panacea for stone and gravel; and fly water was none the less esteemed as a collyrium in various affections of the eye. The tick was good for erysipelas, and the wasp, from its direct action on the mucous lining of the kidneys and on the neck of the bladder, was a most invaluable diuretic. The ladybird (*Coccinella*) was esteemed as a sovereign remedy for colic and measles, and crushed upon an aching tooth was long regarded as a specific for toothache. The same insect (*Coccinella septempunctata*) is now official in the homœopathic pharmacopœia, and in the form of a trituration is supposed to be useful in swelling of the gums and toothache accompanied by dull headache. Gerbi, a learned Italian professor, assures us that if a finger be once imbued with the juices of a little insect rejoicing in the sesquipedalian name of *Rhinobatus antidontalgicus*, it will thereafter retain its power of curing the toothache for a whole year.

In former days ants were celebrated as specifics against leprosy and deafness, as well as for their aphrodisiac virtues; distilled with spirits of wine they formed the *Aqua Magnanimitatis* of ancient medicine, a liquor which was believed to give vigor and animation to the whole bodily frame. The same extract of ants was also considered efficacious in strengthening the memory and increasing the power of loving, and it likewise prevented paralysis and cured ringing in the ears, etc. The chrysalides of ants were said to be diuretic, and they have been used in dropsy. A preparation called "spirit of ants" (*Spts. Formicarum*) is official in the German pharmacopœia, and was formerly much used internally as a stimulant, just as ammonia is usually employed; but formic acid, which is the active agent in the preparation, is not now regarded with favor by the medical faculty, and is little used.

The cockchafer (*Melolontha*) of Europe was once highly esteemed as a remedy for the bite of a mad dog and the plague. Dioscorides is authority for the statement that a plaster of spiders applied to the temples will keep off ague; however

this may be, it is certain that these insects are occasionally used as an internal remedy, in pill form, for a like purpose in some of the Southern States. Triturations and tinctures of one or two species of spiders (especially the *Epeira diadema*) are official in the homœopathic pharmacopœia. Speaking of spiders reminds us that one species (*Tegevaria medicinalis*) has been largely employed in the United States instead of the Spanish fly.

The cochineal insect (*Coccus cacti*) was formerly regarded as a stimulant, antispasmodic and diuretic, and still enters into an old fashioned prescription for whooping cough; but its remedial virtues are so doubtful that it has dropped from the rank of a medicine to that of a mere coloring agent for medicinal preparations. In this capacity, however, it regains something of its lost prestige, for the deeper the tint of the preparation colored with it the stronger the medicine in the imagination of the average patron of the drug store. A similar insect is the kermes (*Coccus Ilcisi*), indigenous to the basin of the Mediterranean, official in the French Codex, and used for the same purposes as the foregoing.

The only insects that have really managed to hold their own in the struggle for existence in the good graces of the regular practitioner, are the blistering beetles (*Cantharis*, *Mylabris*, etc.). These are still extensively used, both as external and internal remedies. In Europe we believe that the Spanish fly (*Cantharis vesicatoria*) is, with one exception, the only species used; but in the United States, although this same species is almost universally employed, yet several of our American blistering beetles have often been substituted for it with perfect success; these being the striped (*Lytta vittata*), the ash colored (*L. cinerea*), the black (*L. atrata*), and the margined blister beetles (*L. marginata*). In China the *Mylabris cichorii* has long been employed, and seems also to have been considered the most powerful vesicator among the ancients, who, however, appear to have been likewise acquainted with the golden cetonias (*Cetonia aurata*) and some others mentioned by Pliny. A species of *Mylabris*, very abundant in Bengal, Bahar, and Oude, has been found equally as efficient as the common Spanish fly; and, in other parts of India, the giant cantharis (*C. gigas*) and the violet colored cantharis (*C. violacea*) are used, as is the red headed blister beetle (*C. ruficeps*) in Java and Sumatra. In Brazil the species used is the *C. atomaria*; in Arabia, the *C. Syriaea*; and in some parts of Europe the *Mylabris trimaculata* is employed. The use of one of the blister beetles, the *Meloe proscarabeus*, was long ago recommended as an antidote to hydrophobia, and a pamphlet on the subject was communicated to the Entomological Society of France by M. Fermaire in 1856; more recently, we have seen it stated that this is a favorite remedy of the Arabs for the same disorder, the beetles employed being *Meloe tucius* and *Mylabris tenebrosa*, and the dose being a piece the size of a grain of wheat given to the patient in a piece of meat. Prepared as a trituration, the Spanish fly is used in homœopathic practice for a like purpose.

Such, then, are a few of the singular remedies that the *ars medica* has from time to time made use of. And now the question arises, Will these insect remedies ever come in vogue again? Will they ever partially replace the many roots, herbs, and barks which, in one form or another, make up our present materia medica? Perhaps so; who knows? A well known medical author writes thus: "There exists a fashion in medicine, as in other affairs of life, regulated by the caprice and supported by the authority of a few leading practitioners, which has been frequently the occasion of dismissing from practice valuable medicines and of substituting others less certain in their effects and more questionable in their nature. As years and fashions revolve, so have these neglected remedies, each in its turn, risen again into favor and notice, while old recipes, like old almanacs, are abandoned until the period may arrive that will once more adapt them to the spirit and fashion of the times." So, then, it may be that the coming cockroach is but the precursors of the "innumerable caravan" of bedbugs, cockchafers, ants, *pediculi*, and others, that are again moving to the front to assert their right to heal man, instead of being a pest to him. And it may be, too, that, based on this practice, a new "pathy" shall arise to supplant one or more of those now in existence, and which shall be called entomopathy. As we before remarked, who knows?

American Elevators in Europe.

We have seen a recent letter from Mr. Petrus Regout, owner of the celebrated glass manufactory at Maastricht, Holland, who states that he has lately put up in his establishment an American elevator, made by Volney W. Mason & Co., of Providence, R. I., which gives entire satisfaction. According to Herr Regout, they subjected the safety devices of the elevator to the following severe test: The platform, which of itself weighed 480 kilos, was loaded with a special weight of 500 kilos more, and the lifting rope was then suddenly cut; but the platform did not fall, being firmly held up by the safety racks. M. Selig & Co., Berlin, the well known engineers, have taken the agency for Messrs. Mason & Co.'s elevators, and are now introducing them in Germany. The above is one of the first practical trials they have had.

Snow and Frost in June.

Severe frost was experienced along the northern tier of States toward the close of the first week in June, and on the 6th snow fell at North Troy, Vermont, and at Sandwich, New Hampshire.

The eruption of Mount Etna has nearly subsided.