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WHAT IT COSTS TO FEED INSECTS.

There are about a thousand species of insects in this country which are injurious to our grain, forage, and field crops, our garden vegetables, fruit crops, and forest and fruit trees. Among them a few are especially destructive. In 1875, it is said, as many as ten thousand settlers were driven out of Kansas by grasshoppers. In Missouri, according to State Entomologist Riley, the damage done by these insects in 1874 exceeded \$15,000,000, and he estimates the losses in other parts of the West at twice as much more, in all, \$45,000,000 for one year's support of these pests. During the same year, the destruction of growing crops by the chinch bug amounted to \$19,000,000 in Missouri alone. Just ten years before, in Illinois, the same insect occasioned a loss of over \$73,000,000 in a single season. The average annual damage to the cotton crop of the country by the cotton army worm is estimated at \$50,000,000. The devastating potato beetle is capable of deducting other millions from the annual profits of our agriculture, and the thousand other insect plagues are easily competent to swell the aggregate annual board-bill of their kind to something like \$200,000,000, according to the estimates of Professor Packard, whose conclusions on a subject like this are well worthy of respect.

If this enormous sum, or even half of it, could be saved, it would soon amount to enough to pay the national debt. The question whether it can be saved, or any portion of it, is certainly worth considering. Professor Packard is confident that, with care and forethought, based on the observation of facts by scientific men, from fifty to a hundred million dollars of this annual loss could easily be prevented by a little co-operation between the several States and the General Government. He would have the former emulate the practical good sense of Missouri and each appoint a salaried entomologist. Then these gentlemen, acting in connection with a United States Commissioner of Entomologists, might issue weekly bulletins, perhaps in combination with the Weather Signal Bureau, reporting the condition of the insect world, forewarning farmers and gardeners from week to week of the insect enemies to be guarded against, and suggesting the preventive and remedial means that should be adopted. The cost would be comparatively slight; the possible good immense.

Take for illustration the grasshoppers, or, more properly, locusts, of the West. They breed chiefly on the great plains beyond the Mississippi, from Minnesota to Texas. In summers of unusual drouth they multiply enormously, and the supply of food being short they are forced to migrate.

Professor Packard tells of a swarm of locusts, first observed at Boulder City, Colorado, which traveled six hundred miles to devastate Eastern Kansas and Missouri. Its original home was somewhere in Wyoming, perhaps two or three hundred miles northward of Boulder City. The locusts fly with the wind; and as the general direction of the wind in those parts during the summer season is pretty well known, the movements of the locust armies can already be predicted with tolerable accuracy. But more knowledge is needed, particularly with regard to the meteorological features of the Western country, and the relation of locust migrations to wind and weather. In the pursuit of these investigations, Professor Packard justly urges that the meteorologists and entomologists must go hand in hand. The government has provided a well organized corps of weather observers, and the addition of a few competent entomologists would increase the outlay but little, while the resultant good would, in all probability, be very great. It would certainly be so if, as seems by no means unreasonable, the service should be able to master the conditions of "locust years," and be able to tell with a good degree of certainty when locust invasions are likely to occur, and how they may be prevented.

In his plea for such observations in the West, Professor Packard observes that "not only should the border States, especially Texas, Kansas, Nebraska, Minnesota, and Iowa, employ entomologists, following the liberal policy of Missouri, which for eight years has had a State entomologist, whose reports have proved of incalculable practical value to the people of that State: but the habits of the locust need first of all to be thoroughly studied in the Territories, particularly in those of Wyoming, Montana, Idaho, Dakota, Utah, New Mexico, Arizona, and in the new State of Colorado. A commission of entomologists should be appointed to make a thorough study of the locusts in the Territories mentioned. It would seem that the recommendation made at the recent meeting of Western Governors, at Omaha, to the effect that an appropriation be passed by Congress, and a commission be attached to the existing United States Geological and Geographical Survey of the Territories (Hayden's), is the most feasible and economical method of securing the speediest and best results."

This is but one feature of the work that might be done with profit toward forestalling the depredations of insects, regular and periodical: a work which must, sooner or later, be undertaken, and which may ultimately prove as beneficial to the country as the weather predictions have been.

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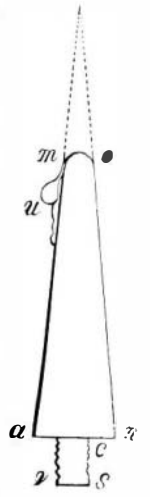
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EXPLOSIONS ON LIGHTNING ROD POINTS.

It is a well known fact that, if a metallic point communicating with the earth be presented to the conductor of an electric machine charged with positive electricity, the angle of the electroscop of the apparatus becomes small. The reason is that negative electricity escapes from the point as soon as developed, and serves to neutralize a quantity of the positive electricity of the conductor, no spark being produced. This phenomenon, as Professor Stroumbou, of the University of Athens, points out, is produced differently when the Holtz electric machine is used. If, while sparks are passing between the two balls of the apparatus, a third ball, having a metallic point attached to it, be taken in the hand and moved nearer one of the fixed balls, when the intervening distance becomes so small that the negative electricity of the point may escape the sparks at once cease. Yet, if the point be removed, they begin passing again between the two balls. This experiment can be repeated indefinitely. Now if the distance between movable and fixed balls above mentioned, at which no sparks pass, be gradually augmented, at a certain stage sparks will reappear between point and fixed ball. The conclusion from this is that, if the negative electricity of the point has great intensity, sufficient to enable it to escape from the point and pass over the interval, there will be no spark between point and fixed ball; but if the negative electricity of the point has not intensity sufficient to cause it to escape as soon as developed (the attraction then diminishing inversely as the square of the distance), there will be an explosion on the point itself, and electric sparks will occur constantly between the point and fixed ball, just as between the two balls of the machine.

During storms, the atmosphere is charged with enormous quantities of electricity, which, however, in their action should follow the same law as the smaller quantities produced in electric machines. If then a cloud, having positive electricity in determinate quantity, passes not too far away from the lightning rod point, analogous effects will take place. Then electricity developed by induction on the lightning rod will continue to escape at the point as soon as it gets there, and will go to neutralize the positive electricity of the cloud, neither thunder nor lightning being produced; but in case the same cloud were placed too far away, according to the experiments above detailed, an explosion might follow at the point of the rod, an intense heat would be developed, and the platinum point of the rod would be fused. This phenomenon occurred at the Royal Palace of Athens, where the platinum point was found melted, as shown in our illustration, which represents the rod in its full size.



THE INDUSTRIES AND RESOURCES OF NEW SOUTH WALES.

There is no people for whom we as Americans may cherish a more genuine fellow-feeling than for the colonists of the British Australian possessions. Sprung from the same parent stock as ourselves, during the hardships and privations incident to the settlement of a new and distant region as did our own ancestors, they have achieved results and can point to a progress which may justly claim to find its only parallel in our American advancement. No better proof could be asked to show that the energy and industry of the Anglo-Saxon are race characteristics, and that they will manifest themselves irrespective of the region which may chance to be their field of exertion.

Not three generations ago, Australia was but a frontier of barbarism. Now the continent is fringed with infant States already able to exercise the powers of elaborate political systems. Within thirty years, the population has risen from 214,000 to 2,000,000 souls, the trade from \$30,000,000 to \$315,000,000. There are nearly 5,000,000 acres of land under cultivation, 70,000,000 head of live stock on the pastures, 2,000 miles of railway and 26,000 miles of telegraph completed, and the revenue of the several governments aggregated \$350,000,000.

The mother colony of those which thus far have been established upon the Australian continent is New South Wales; and for a most valuable exposition of the resources, industries, and requirements of that political division we are indebted to Mr. George H. Reid, of Sydney, a copy of whose essay is now before us. The great need of the colonies—the need which overtops all others—is for men. The chief articles of her export trade are raw materials; and that these exist in abundance there is no question. But enterprise is paralyzed when hands fail; and therefore New South Wales now asks all nations, not for their custom nor for their money, but for their surplus population. The underpaid agricultural laborers of England, the great throngs of working men of the United States who, when the panic of 1873 checked enterprise here, were thrown out of employment—any one, in fact, blessed with good health and sturdy muscles, the new colony will gladly welcome, and provide with steady and remunerative work.

Mr. Reid's essay is primarily designed to exhibit in some detail the inducements which the colony offers to immigrants, and of these we summarize below those regarding which a workman would naturally first ask to be informed. The area of the colony is 323,437 square miles, that is about as large as the New England States, New York, Pennsylvania, New Jersey, Delaware, Ohio, Indiana, Illinois, and about a

third of Iowa, combined. The climate is remarkably salubrious, the death rate is low, and epidemic diseases are rare. Means of intercommunication consist of 692½ miles of finished railway and 8,012 miles of telegraph wire, and 561 additional miles of railway are projected. The telegraph is under government control, and a message of ten words may be sent to any part for one shilling. The Post Office includes a system of government savings banks. The public debt is not more than three years' revenue. Land for settlement can be obtained of the government in any area between 40 and 320 acres for \$4.84 per acre, payable on easy terms.

The present mainstay of Australian prosperity is live stock, and this is conspicuously true of New South Wales. The value of cattle, horses, etc., in the colony in 1875 was over \$35,000,000, and the wool export is very large. There is no part of the country where sheep and cattle will not thrive; and with the improvements which are constantly being made in the preservation of meat, it is likely that before long the rearing of live stock for consumption in Europe will become a great and valuable industry. The soil is suitable for the cultivation of all northern cereals, coffee, tea, tobacco, cotton, sugar, olives, cinchona, indigo, and rice, besides the fruits of the temperate and semi-tropical zones. The demand for agricultural laborers is therefore especially marked. There are abundant coal resources, the approximate coal area being 24,840 square miles. The gold mines are believed to be extensive, but labor must be had before they can be developed. Tin and copper are largely mined, and a fine quality of iron is obtained. There is a diamond area of 500 square miles, and in gems of all kinds the country is remarkably rich. The larger manufacturing industries include ship and boat building, brick making, milling, tanning, engineering, foundry work and pottery—all of which are carried on in extensive establishments. Of the minor industries, nearly all are represented as in a flourishing condition. The eight hour rule in labor is generally followed. Taxes and rents are low, while wages are fair. A bricklayer, for example, can earn in Sydney from \$2.50 to \$2.75 per day. Building laborers get from \$1.50 to \$1.75. In the iron trades the pay for eight hours' work ranges from \$2 to \$3 per day. Painters receive from \$8 to \$15 per week. In the gold mines, a day's wages is, for eight hours, \$1.87 to \$2.08; in copper mines, same time, \$2.08 to \$2.60; in coal mines, five hours' work, \$2.35; in iron mines, nine hours' work, \$1.75 to \$3.50. As regards the cost of living, a house containing 6 rooms may be hired in Sydney for from \$3.50 to \$5 per week; in the suburbs this rent falls as low as \$2.50 to \$3.50 per week. Smaller houses ranging down to three rooms are proportionately lower in price. In the matter of food, beef sells for 8 cents per lb., flour 3½ cents, bread the same, sugar 6 to 8 cents. Generally the prices are high, in some respects notably so, as butter is quoted at 50 cents per lb., milk 16 cents per quart, and bacon 25 cents per lb.: but these are Sydney rates, and the cost of living appears to be somewhat less in the country, while wages out of the city average rather higher.

Of course the chief advantage offered to the immigrant is steady work, which is to be supplied both by private enterprise and by the expenditure of some \$20,000,000 of surplus public revenue for the construction of railways.

THE WORLD'S POPULATION.

The present population of the world is somewhere between fourteen and fifteen hundred millions, the latest and perhaps most trustworthy estimate, that of Drs. Behur and Wagner, placing it about midway between the limits we have mentioned. The impossibility of estimating the number more closely will be apparent when it is remembered that only in a comparatively small part of the world have careful censuses, or indeed censuses of any kind, ever been made. A systematic enumeration of the inhabitants of India a year ago discovered that the population of that great empire had previously been under-estimated by upwards of 25,000,000, or as many nearly as the population of England, Scotland, and Wales. The census returns of Europe are tolerably complete, the leading States standing in the following order in point of numbers:

Russia.....	1870	71,731,000
Germany.....	1876	42,723,000
Austro-Hungary.....	1876	37,700,000
France.....	1872	36,103,000
Great Britain.....	1876	33,450,000
Italy.....	1875	27,482,000
Spain.....	1870	16,552,000
European Turkey.....	—	8,500,000
Belgium.....	1874	5,337,000
Roumania.....	1873	5,073,000

Sweden and Portugal slightly exceed 4,000,000 inhabitants each; the Netherlands fall a little short of that number; Switzerland fails to reach 3,000,000; while Denmark and Norway fall somewhat below 2,000,000. Greece and Servia fall short of a million and a half each, and the smaller States together add less than half a million more. The aggregate population of Europe is thus a little over 309,000,000, giving a density of 82 to the square mile.

The population of Asia, according to the same authorities, is about 824,500,000, or 48 to the square mile. The most populous nation is China, with over 400,000,000 people. British India has about half as many; Japan over 33,000,000; Turkey in Asia about 13,500,000; Asiatic Russia about 15,000,000. Africa has a population close upon 200,000,000, America about 85,520,000; Australia and Polynesia less than 5,000,000. The density of the African population is 17½ to

the square mile; of America, 5½; of Australia and Polynesia, about 1½ to the square mile.

There are ten cities in the world that have a population of a million or more, namely: London, with 3,490,000; Paris, 1,852,000; New York (with Brooklyn), 1,596,000; Constantinople, 1,075,000; Berlin, 1,045,000; Vienna, 1,001,000; and Canton, Seangtan, Shanchowfu, and Siangfu, in China, with 1,000,000 each. There are twenty-nine cities with 500,000 or more each; and 215 with 100,000 or more people.

PATENT RIGHTS AND PATENT WRONGS.

The old saying, "out of the frying pan into the fire," is always worth heeding. The single circumstance that a degree of mischief is the outcome of any custom or law is not in itself a sufficient reason for the condemnation of such law or custom. As this world of ours is constituted, good and evil ever go together. There is nothing so beneficent that it may not sometimes do harm. Even the Gospel of Peace has more than once brought discord and the sword. Reform is always in order; but before it is undertaken in any case, it should first be made clear that something better is possible, and that the harm likely to be done in the process of substitution will not be greater than will result from leaving things as they are.

We have little sympathy with those who persist in regarding the patent system of the United States as the source of unalloyed good. We are equally far from sympathizing with those who cry "away with it," or would change its provisions at a venture simply because it is, or appears to be in some cases, the instrument of "oppression." Like everything else we have to do with, it is something experimental, aiming to secure the greatest good to the greatest number, but making no pretence to infallibility or absolute beneficence.

That strong *ex parte* arguments can be brought against its workings in some particulars is undeniable; but on the other hand, the advantages directly traceable to it are enormous, vastly overbalancing, we believe, the evils wrought by it or in its name. The part of true statesmanship therefore seems to be, not to abolish the system outright as some demand, nor to emasculate it as others would like to do; but to determine the sources of the evils which attend its workings, and then, if possible, modify the system so as to obviate those evils without opening the door for the entrance of greater evils.

The charges against the patent system as it now stands are certainly serious, or, more correctly, some of them are. Others, like the following from a late issue of the Chicago *Times*, are simply ridiculous, to wit: "That the patent system is an oppressive nuisance; that it has proved itself the reverse of a stimulant to the inventive faculties of the American people; that its original purpose, to secure to inventors a reasonable recompense for their study and ingenuity, has been prevented, and that not one inventor in a thousand receives any substantial benefit from his invention."

The patent falsity of charges of this sort prevents their imposing upon anybody capable of observation or honest thinking. Not so, however, the charges based upon truth and experience: for example, that a patent right is for a time the monopoly of the possessor; that it allows the patentee to restrict the liberty of all other men to the extent of denying them the privilege of using something they want except on such terms as he may dictate; that it allows a patentee to prevent absolutely, if he will, the use of a patented device or process, for a term of years, to the manifest detriment of the common wealth; and that it allows the owner of a patent or a combination of patents to levy enormous taxes on the country's industrial or natural resources, while the inventors, for whose benefit the patents were issued, get little or nothing for their rights.

Let such charges—the worst that can be brought against the patent system—be granted as true. Does it follow that the system should be abolished? Certainly not, whatever the Chicago *Times* or others of the anti-patent school may demand, unless it be first clearly demonstrated—

That the patent system as a whole has been no help, but rather a hindrance to the development of the country:

That the owners of patents have been more favored by law than the owners of other species of property:

That the admitted evils of the patent system are inseparable from it, and that no mitigation of them is possible except with the abolition of the system.

Touching the first very little need be said. The verdict of history, of common sense and common fact, is against it. Even in the case of the patents which have given rise to the most "oppressive" monopolies—mowing machines, cultivators, sewing machines, vulcanized rubber, telegraphy, railways, and the rest—it is easy to show that they have been of enormous advantage to the country, and have added vastly more to the wealth of the people who have been "oppressed" by them than they have taken away. It is true that the owners of such patents have often been greedy of gain and have amassed great wealth; but what are their fortunes compared to the aggregate wealth of those who owe what they have almost entirely to the aid they have received from the very patents they complain of?

The chief opponents of the patent system are the Western Grangers, whose narrow views have been represented in the recent anti-patent enactments of their State legislatures and also in the bill now pending in the United States Senate. Have those same Grangers ever seriously asked themselves the question where their organization and the wealth it represents would have been—where they personally would have

been—had there been no patent system to encourage inventions, and no fruits of such a system to make the cultivation of the interior wilderness possible, or to enable its pioneers to send its products to a profitable market? We hazard the assertion that the "obnoxious" patent system, and the inventions it has encouraged, have done more for the Grangers than they have ever done for themselves.

But, it is objected, on their part, the owners of patents have been and are unduly favored in the struggle for existence. They have been too much protected, to the grievous injury of the users of their inventions, particularly the agricultural classes.

Let us see: Let M., a mechanic, represent the patentees, inventors, and owners of patents, as a class. Similarly let F., a farmer, represent the Grangers. F., strong in hope and health and muscle, goes to the wilderness and clears a farm. For the work so done, or for a merely nominal payment, the general government grants him a section of land. The grant is absolute and for all time. Meanwhile M. is devoting his energies to the perfecting of some useful device. He succeeds, and the general government gives him the right to make and sell his invention—for all time? No; but for a period of a few years only. So far, certainly, the inventor is not unduly favored.

We will suppose that the invention is so important and useful that, before the life of the patent expires, the inventor has amassed a noble fortune; or better, suppose that the inventor, unaware of its importance, sells it at the current rate for patents, according to the opponents of the system, "a song," and the property passes into the control of a scullion corporation, which is enabled thereby to monopolize an extensive line of manufacture, and so acquire no end of riches. Better still, suppose this grasping corporation, which owns something that the multitude cannot afford to be without, and charges accordingly, becomes so rich that before the expiration of the patent it is able to secure a renewal of it, and so continues for another term of years to "prey upon the people." The end comes at last, and then the invention becomes a portion of the common wealth. The patentee or his successors have been greatly favored truly; but is their case entirely unique?

Let us see how our pioneer Granger has fared meanwhile: The title made out, the land is his to use or let alone as he will. He can let it lie unproductive, not merely for seventeen years (like an undeveloped patent), but for any time he may choose; and he can keep anyone else from cultivating it except on such terms as he may dictate. His monopoly is, then, as complete while it lasts as a patentee's, and it lasts for ever. Suppose he has made a happy selection and has chosen a valuable site for water power, or that the land is found to contain precious metals, or that it happens to be where a great commercial center is destined to be. He, unlike the inventor, has added nothing to the world's wealth, yet purely through the necessities of others he may gain great wealth by what is called the natural rise in value of real estate; and the law of the land defends his title.

To parallel the case of M., suppose F. to be ignorant of the present or prospective value of his homestead, and that he sells it, as M. did his patent, for a song. The buyer may improve the property or let it lie fallow, just as he pleases. He may leave it for generations, a serious bar to the development of the surrounding community, who may sorely need the water power, the useful minerals, or the advantage of the commercial situation it covers; or he may turn their necessities to his advantage and charge enormously for what owes its real value not to the owner's efforts but to the labors of others who have been hindered rather than helped by his negative action. We might point as an illustration to one of the oldest cities of New England, which from its natural advantages might have been one of the most prosperous, but is now a tenth-rate place simply because those advantages have been monopolized by a family that would neither develop them or allow them to be developed by others. The vast fortunes that have come to the Astors and similar owners of landed property, which has been made valuable through the energy of other men, tell the same story.

The worst possible cases of patent "oppressions" are trivial compared with the burdens which rising communities have had to bear through speculations in land. Shall we say, therefore, that private ownership of land is injurious and ought to be abolished? Or, because the great landed fortunes have not fallen to the working pioneers, that the land laws of our country have not encouraged emigration or hastened the development of the country?

The inventors, if they would, could make out a far stronger case against the landowners than the latter against the patentees; but only by overlooking, as the Grangers do, the very important circumstance that, however great the local evils of either system may have been, the good has preponderated enormously. And the charge of favoritism can be returned with interest, for the patentee's monopoly is limited, and in a few years his invention becomes public property, whereas the landowner's monopoly is perpetual.

There remains the question whether the patent system can be modified so as to mitigate the alleged evils of its workings without impairing in any serious degree its efficiency as a stimulant to invention. We are inclined to think it may; but the case is not as clear that sudden or reckless changes are advisable. This question, however, is too important to be discussed at the tail of a long article. We reserve it, therefore, for subsequent consideration.