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THE SCIENTIFIC AMERICAN SUPPLEMENT

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PROGRESS OF PETROLEUM.

The efforts of the great majority of the Western Pennsylvania petroleum producers to obtain relief from what they deem the oppressive acts of the Standard Oil Company and the unjust discriminations of the United Pipe Lines, and the various railroads traversing the oil regions, have attracted more than usual attention to the present condition of this industry and its possible future.

We would here explain that the Standard Oil Company originated in Cleveland, Ohio, about twelve years ago, and was incorporated under the laws of Ohio, with a nominal capital now, we are informed, of $3,000,000, which, however, very inadequately represents the financial strength of its members. It is now a combination of the most prominent refiners in the country, and has before been credited with manipulating the transportation lines to its own special advantage.

We can recall no instance of such serious hostility between parties whose interests are at the same time of such magnitude and so nearly identical; nor can we see what substantial, enduring benefit would accrue to the producers in the event of their victory in the struggle.

They charge that the Standard Oil Company has become the controlling power to fix prices and to determine the avenues by which the oil shall be transported eastward for home consumption and for foreign exportation; that the railway companies have given this company lower rates than other parties for transporting the oil; and that through the rates given to it by the railways the value of their property is destroyed.

The reply, in effect, is, Granting all this to be true, what does it amount to? Neither more nor less than that the managers of the Standard Oil Company, by combination of capital, by intelligence and shrewdness in the management of their operations, have built up a successful business, and that they have so extended it by the use of all practicable appliances, and by the purchase of the property of competitors, that they do practically control the prices of oil, both crude and refined, and that the uncombined capital of the other oil producers, lacking the power, the intelligence, and the business skill which combined capital can secure, cannot compete with the Standard Oil Company. Now, is there any great wrong or injustice in this?

When brains can command capital it is always more successful in business matters than any amount of brains without capital or capital without brains. This result is the natural working out of the same principle that is everywhere to be seen—some men are successful and others are not.

It is the essence of communism to drag down those who succeed to the level of the unsuccessful.

If men cannot compete with others in any business they must accept the fact, and try some other employment.

If, through superior intelligence and capital, the Standard Oil Company can control the oil business of Pennsylvania, then, according to the principles of common sense, it must be permitted to do so.

What right, then, has the oil producer to complain? Why, if all that is alleged is true, will they persist in sinking more wells, when, as they say, they are controlled by the Standard Oil Company? No one forces them to lose money by continuing in the business. Let them find other employment. They do not show that the Standard Oil Company does anything that combined capital on their part and equal business ability could not effect.

The cry of monoply in this case is altogether unfounded, those opposed to the Standard Oil Company having just as much right to do all that that company does, and, therefore, there can be no monoply, because they have no exclusive powers.

As to the railway companies, they can afford and have a right to transport the tonnage offered them by the Standard Oil Company at less cost, because it costs them less to do a regular and large business than an irregular and smaller one. They would simply be acting in accordance with business principles the orld wover.

These are the arguments, the statement of the position of a successful combination confident in its resources and of victory in the coming struggle. The justness, the correctness of the doctrines enunciated, and the wisdom of so doing at this crisis, we do not propose to criticise; but it is very safe to say that if the prosperity of the complainants depends upon relief in this direction they may as well cease producing.

There are too many of them for harmonious and concerted action against the powerful corporations they complain of; and if they should succeed in securing equal transportation facilities the prices would still be regulated by the monopolists, who carry more than four-fifths of the accumulated stock of the oil regions.

The proposed appeal to Congress to pass some law whereby each producer can compel railroad companies to carry his produce at regular rates, amounts to a confession of the desperate straits of the producers and of their weakness as well; and even if successful, which is most improbable, would not remedy the deplorable existing state of things.

Still lower rates would fail to give relief, with all the present avenues of trade filled to repletion and with an increasing output at the wells. Relief and permanent relief can be found only in the direction we have before indicated: in the general application of petroleum and its products to the manufacture of gas for illuminating and heating purposes, and its substitution for coal in the metallurgic and other prominent industries of the world.

THE LIMIT OF WORK.

In distributing the prizes to workmen at the Paris Exhibition, Louis Blanc, the leader of the French Republican Socialist party, quoted approvingly these words of Simonde de Sismondi:

"If the workman were his own master, when he had done in two hours with the aid of machinery what would have taken him twelve hours to do without it, he would stop at the end of the two."

M. Blanc had been discussing very eloquently, but also very fallaciously, the relations of machinery to labor. If men were properly united in the bonds of association, he said, if the solidarity of interests were realized, "the happy result of the application of mechanical power to industry would be equal production, with less of effort, for all. The discovery of an economic method would never have the lamentable consequence of robbing men of the work by which they live. Unfortunately, we are far from this ideal. Under the empire of that universal antagonism which is the very essence of the economic constitution of modern societies, and which too often only profits one man by ruining another, machinery has been employed to make the rule of the strong weigh more heavily on the weak. There is not a single mechanical invention which has not been a subject of anguish and a cause of distress to thousands of fathers of families from the moment it began to work."

If all this, and much else that M. Blanc alleges, were true, then the condition of all workingmen to-day should be in every way worse than that of their fathers, in anti-machinery days. But such is not the case. There never was a time when the laborer toiled less or enjoyed more than in these days of machinery; and the laborer's condition is best where the machinery is best and most used.

A hundred years ago the laborer toiled long, produced little, and enjoyed less. To-day, thanks to the victories of invention, machinery does the heaviest of the work; the workman's hours of labor are fewer than formerly; his wages are greater; and his earnings will buy vastly more, dollar for dollar, than in any previous age in the world's history.

What laborer of to-day would be satisfied with the remuneration, the food, the shelter, the clothing of the laboring classes of one hundred years ago? The wants of men, as well as their thoughts, are widened by the process of the suns. And in no section of society have the daily wants been more markedly increased, or the facilities for gratifying them either, than among those that live by labor.

"If the workman were his own master, when he had done in two hours with the aid of machinery what it would have taken him twelve hours to do without it, he would stop at the end of the two."

So says the thecretical socialist. The practical workman never has, nor, we believe, ever will, act so foolishly; certainly not until the limit of man's capacity to enjoy has been reached. When the united products of manual and mechanical effort fully satisfy the desires of all men, and leave no margin of want unfilled, then and then only will men be satisfied with the reduction of effort demanded by the socialists. Until then the larger part of every increase in production by mechanical improvements will go to swell the volume of good things for human use and enjoyment. Our machinery enables our thousands of busy workers to accomplish what millions could not have done years ago, and a very large part of the aggregate increase of product comes back to them in conveniences and luxuries surpassing those the wealthiest could enjoy were machinery not employed, or were it employed, as the socialist advocates, without increasing the aggregate of production. The laziness of the savage and the advantages of civilization are incompatible. The chief merit of machinery lies in its enabling us to multiply constantly the scope and variety of our enjoyments without a corresponding increase of toil.

IRIDESCENT GLASS.

Ornamental glassware in many styles, tinted with the glowing colors of the rainbow, is now making its appearance in the shop windows of Broadway and Fifth Avenue. This is one of those brilliant little achievements of science that delights the eye and pleases the imagination. To produce the colors, the glass, while in a heated state, is subjected to the vapor of chloride of tin. Shades of more or less depth or intensity are imparted by adding to the tin chloride a little nitrate of strontium or barium.

RAILS AND RAILWAY ACCIDENTS.—NEW YORK ACADEMY OF SCIENCES.

A meeting of the Section of Physics, New York Academy of Sciences, was held November 25, 1878. President J. S. Newberry in the chair. Numerous publications of learned societies were received and acknowledged. Professor Newberry read a letter from Professor Agassiz stating that sea lilies, which had hitherto been very rare—a single specimen bringing as much as fifty dollars—have been found in some numbers by dredging in the Gulf of Mexico. Their colors are white, pink, and yellow. Professor Newberry also exhibited specimens of garnet from California, lamellar quartz from North Carolina, sharks' teeth belonging to the eocene and miocene tertiary ages from the phosphate beds of South Carolina, and a number of shells.

Professor Thomas Egleston then addressed the Academy on the subject of "The Structure of Rails as Affecting Railway Accidents."

The destruction of rails is due to three causes. 1. De-

fects in the manufacture; 2. Improper mechanical or chemical composition; and 3. Physical changes.

A very large number of rails are annually made which should never be put in any track. Their defects are often imperceptible to the naked eye, but they very soon begin to break. Statistics show that the breakage from defects in making increase until they have been used 18 months; then it decreases to zero, and after that rails break from different causes. In France, breakage usually begins in December, reaches its maximum in January, and becomes normal in April. As a more intense cold would be necessary to explain such breakage than that which is felt in that climate, the cause must be sought in the stiffness and inelasticity of the frozen road bed. The impact of the locomotive is then apt to break the rail, very much on the same principle that is taken advantage of in breaking them up for the manufacture of smaller objects. A nick is made somewhere, and the workman then strikes a blow with a hammer at a point between the nick and the place where the rail is supported. This will sever the rail at the nicked place. Sometimes more than a second intervenes between the blow and the fracture. Now, whenever holes are punched in rails for the fish plates, flaws are apt to radiate from them; and if these flaws are not planed or filed out, they may cause the rail to break, just as the nicks above mentioned. Such rails have been known to last no longer than 18 months, and some have actually broken on the way from the manufacturer to their destination. There are establishments in this country and in Europe where they "doctor" such rails by filling up the flaws with a mixture of iron filings, sal ammoniac, and some adhesive substance. Beware of them; a poor cheap rail is dear at any price. The French government stipulates in its contracts for rails, that flaws shall be planed, drilled, or filed out; that the rails shall not be allowed to drop on the ground, but shall be carried by men and slid down. The Lyons railroad does not pay for its rails until 15,000 trains have passed over them.

By imperfect mechanical composition is meant imperfect union of the parts of rails. Steel heads are welded to the rest of the rail in a variety of ways, and this welding is necessarily imperfect. A number of sections of rails etched with acid plainly showed this want of homogeneity, as did likewise prints taken from the etched surfaces. Before such rails have lost weight appreciably, they are used up by the constant rolling they undergo. The advantage of a steel rail is its homogeneity, but a good iron rail, such as those made under the direction of the speaker, for the Reading Railroad Company, is likely to prove better than one of poor steel. The life of a steel rail is chiefly affected by the temperature at which it is rolled and annealed. It ought not to wear off more than 1 mm. for 20,000,000 tons of traffic, and is usually calculated to wear 10 mm. before it is taken up. In other words, it would last about 20 years on roads doing as much business as the New York Central. It is, however, unlikely that our steel rails will stand more than half this amount of traffic.

The effects of chemical composition are but little understood. Some of the purest irons have turned out utterly worthless. Apparently the absolute quantities of carbon, silicon, aluminum, phosphorus, etc., present are not of so much importance as their relative proportion. One specimen containing carbon 0·16, silicon 0·08, and phosphorus 0·012, could be bent double when cold, while another, containing carbon 0·58, silicon 0·56, and phosphorus 0·011 broke at once.

The physical tests for tensile and torsional strength, usually made on a portion cut out of the head of the rail, are not sufficient, because the flaws before spoken of exist mostly in the flange of the rail, and fracture usually begins there.

The effect of cold rolling and shocks that a rail is exposed to was shown by a piece of rail made by the Campbells, Sheffield, Eng., which had been worn 3 mm. by a traffic of 60,000,000 tons at Spuyten Duyvel. The head had been somewhat flattened, and the flange driven down into the foot to a certain extent. Under such usage an iron rail would have gone to pieces long ago.

Sometimes steel rails crumble all at once and pieces fall out of the head. This is probably due to some physical defects or to crystallization from shocks. The cause has not yet been definitely ascertained.

Mr. Collingwood stated that of a rail only a section of ⅜ square inch was pressed by the wheel of a locomotive, the effect being to cause this portion to act like a wedge, and thus to contribute to the disintegration of the rail. He also exhibited a hook which had been used to hoist stones of 10 to 12 tons, and then suddenly broke with a weight of only 6½ tons. It had been worn from a thickness of 2 inches to 1⅞. The pressure at the upper surface crowded the particles and caused them to act as wedges. Their fracture was crystalline, while that of the lower surface, which parted more slowly, was fibrous.

Professor Egleston asserted that there was no such thing as fibrous iron; what appeared so being simply crystalline with the ends drawn out. A sharp blow would cause this to fall off and show the crystalline structure beneath.

The discussion was continued by Professors Trowbridge, Egleston, and Newberry. C. F. K.

FORMATION OF IODIFORM.—All mixtures in which alcohol and iodine enter in combination with any alkali forming colorless solutions go in part to the formation of iodiform. Even chloroform and iodine, forming a colorless solution, give rise to the same product.—*L. Myers Connor.*

SANITARY SCIENCE IN THE UNITED STATES.

The following is an abstract of a paper on the Present and Future of Sanitary Science in the United States, read by Professor Albert R. Leeds, of the Stevens Institute of Technology, before the New York Academy of Sciences at their meeting, November 11th, 1878:

Sciences, such as the one under consideration, that have in them a side largely practical, are sure of a welcome in our midst. The study of the laws of public health grew into prominence in this country during the war, when the Sanitary Commission undertook to supervise the camps and hospitals. Sanitary associations were then formed in many States and smaller communities, and these have led to the establishment of State and city boards of health, clothed to a greater or less degree with executive functions. Every epidemic has been the cause of wider dissemination of sanitary knowledge by the daily press. The yellow fever plague, by which more than twelve thousand people have perished, has thoroughly aroused public interest. During its continuance the papers were full of homilies on private and public hygiene, the people everywhere sent aid and sympathy to the afflicted, and a lady offered to defray the expenses of a scientific commission of sanitary experts to inquire into the cause and prevention of the scourge. The proper execution of sanitary laws depends on the free and intelligent co-operation of individuals much more than on the influence of a strong central authority. A general health department at Washington could not legislate pure air, pure water, and pure food into use throughout the nation. The people themselves, in each community, must be educated to demand these requisites of health and to secure them in their own way.

I. *Vital Statistics.*—The first "Bill of Mortality" in New York city extended from November 1st, 1801, to January 1st, 1803. In it people are said to have died of "flux," "hives," "putrid fever," "breaking out," "stoppage," "fits," of "rash," and, by way of contrast, of "lingering illness." This rude beginning gradually led to the organization of the Metropolitan Board of Health, whose first report was made in 1866. Their second report showed a decrease of 3,152 deaths, mainly in districts where the greatest amount of sanitary work had been done. Valuable illustrations of the relation between damp houses and consumption were obtained by constructing maps of certain wards, on which every death from phthisis for several years was noted opposite each house. It was found that the disease was most fatal in the lowest levels, in rainy seasons, and in crowded localities.

The registration of marriages continued so defective that a writer on the subject declares it would be impossible for a large portion of the adult native population of the United States to prove by any legal document that they have a right to the name they bear, or that their parents were ever married. The mortality returns of 1871 were probably nearly perfect, and their very accuracy told against New York city, whose death rate was 28·6 per thousand, while St. Louis reported 17, Rochester 16, Buffalo 14, and Jersey City 7 per thousand. To secure accuracy in the returns of marriages and births, etc., more stringent legislation will be necessary.

In New Jersey the State Sanitary Association has conclusively shown the utter worthlessness of the State vital statistics. They memorialized the legislature, and caused the passage of a law which gives to New Jersey one of the best systems of registration yet devised. It owes its excellence to the following features, which should be universally copied:

1. *Burial Permits* are issued only after registry has been made by a properly qualified person; and

2. The returns are made to an *expert,* who collates them and deduces practical lessons from them.

II. *Registration of Disease.*—A large class of diseases may be prevented from becoming epidemic if their existence is known in time. For this purpose the boards of health should be invested with power and provided with means to investigate, reform, and, if necessary, to punish delinquency. Yet in the face of so practical a requirement little more is annually appropriated for the Board of Health of New Jersey than for the pay of two policemen.

III. *State Sanitary Legislation.*—The agitation for sanitary reform caused by the yellow fever should not be allowed to die out with the pressure of the calamity that aroused it. It should continue until every State that has been the seat of yellow fever, year after year, has as efficient a health code as Massachusetts and Michigan. The necessity of educating the people before it is possible to secure the requisite legislation will cause a considerable period of time to elapse before all the States have laws in accordance with modern knowledge. Probably no community takes the trouble to protect itself until it has actually suffered. To the distress of London the world owes the report of the Royal Commissions on water supply and the pollution of rivers, still the best repertory of the best knowledge on the subject. The manufactories of England have made it necessary for the government to take cognizance of aerial impurities. Similarly in this country the pollution of the Passaic has caused inquiries to be set on foot in the same direction.*

An attempt was made to deprive the inhabitants of New York of their public parks, and to occupy them with buildings devoted to military and other purposes; but the people had already been sufficiently educated up to an appreciation of their sanitary value not to permit it. Dr. Seguin eloquently advocated the improvement of the parks, to make them not only pleasure grounds, but places of æsthetical and practical out-door education of the public school children.

IV. *Ventilation.*—It would be a great step in the interests of sanitary science if builders, vestrymen, and school or hospital trustees could be persuaded that their offices did not make them temporary authorities on ventilation, and that they had best intrust this matter to specialists who have fought their way into successful practice.

It appears that both the system of ventilation by aspiration and that by propulsion have had great successes and great failures. Many authorities have declared in favor of mechanical ventilation, yet in most institutions where fans had been introduced they are now standing still. In Roosevelt Hospital, New York, they ran their fan backwards for months and then stopped it.

V. *Physical Education.*—Instruction in hygiene and physical exercise as a part of the college curriculum was first successfully accomplished at Amherst College, and has now had a trial of nearly twenty years. The importance attached to it is shown by the fact that only distinguished members of the medical profession are appointed as professors, and that they have the same rank as the rest of the faculty. Their first duty is to know the physical condition of every student and to see that the laws of health are not violated. In case of sickness, the students are given certificates to excuse them from attendance and are put in the way of obtaining suitable treatment. The records kept are of great interest. All the classes are required to attend the gymnastic exercises four times a week. For a full account see Professor Hitchcock's report on Hygiene at Amherst College to the American Public Health Association. The excellent results of this feature—it can no longer be regarded as an experiment—recommend its introduction in all our colleges and public schools.

VI. *Health Resorts.*—The number of people who leave the cities in the summer to visit the seashore, the mountains, and the country is annually increasing. A healthful village is often changed to a center of pestilence merely by such an influx of strangers, the ordinary means of removing offal, etc., being no longer adequate. The town of Bethlehem, N. H., became so popular by reason of its pure air that several thousand hay fever patients sought relief there in 1877. The consequence was insufficient drainage; but as the inhabitants understood their interests, this defect was at once remedied.

The sea shore of New Jersey from Sandy Hook to Cape May is becoming an almost continuous city, and harbors a multitude of visitors every summer. Those whose interest it is to retain this patronage cannot have it too strongly impressed upon them to preserve their healthfulness by introducing cemented cisterns, by causing garbage to be removed daily, and by encouraging local boards of health.

VII. *Illuminating Gas* not only withdraws from the air of our rooms a considerable amount of oxygen, but fills them with noxious products of combustion. All this may be avoided in the future by the introduction of the electric light.

VIII. *Sanitary Surveys.*—Dr. Bowditch has shown that a thousand deaths from consumption in Massachusetts are due to a wet and retentive soil, and this fact alone will show the importance of sanitary surveys of the country, such as that made of Staten Island by Professors Newberry and Trowbridge, who determined the influence of the surface soil, of the underlying rock, its porosity, its bedding and its joints, upon the drainage and upon the local climate and health. A similar survey of Hudson county, New Jersey, has been recently made by L. B. Heard, C.E.

IX. *Composition of the Atmosphere.*—The English government has been obliged to appoint the celebrated Dr. Angus Smith to examine the effects of atmospheric contamination. In Philadelphia there is scarcely a house front that is not disfigured by the stain of magnesia and lime salts, caused by acid vapors in the atmosphere.

A discussion followed, which was introduced by Mr. Collingwood, who remarked that the problem of the sewage of cities was still far from being solved. Though the recent experiments in England on utilizing sewage for agricultural purposes by filtration and otherwise were reported to be successful, we had only dodged the question in this country. Our sewage is still emptied into rivers to poison the water of cities further down their course. When the country becomes more thickly settled, this will answer no longer.

It was also stated that while gas in large chandeliers could be made an effective means of ventilation, there was another objection to its use in the fact that the soil of the city was everywhere impregnated with it from leaky mains, thus causing poisonous exhalations and an insufferable odor whenever the ground was opened. Attention was also called to the evil effects of the system of tenement houses, which led to an unfavorable comparison of the health and morality of New York with those of cities like Philadelphia and Cleveland, that abound in small homes.

Dr. Minor attributed disease to what Richardson calls "ultra-microscopic molecular aggregates," which always exist in the air, but take hold of us only when our vitality is reduced to a certain point. It has been shown that decay is absolutely impossible in vessels from which they are excluded. But for them the earth would now be heaped with the undecomposed remains of animals and vegetables. According to this view, the future efforts of sanitary science must be simply in the direction of learning how to protect ourselves against the "ultra-microscopic molecular aggregates." C. F. K.

* See Report to Board of Public Works of Jersey City by Professors Wurtz and Leeds; also, Analyt. Beiträge aus dem Laboratorium des Stevens Institute of Technology, by Professor Leeds, in *Zeitschr. fur Anal. Chem.* 1878.