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HESABLISHED 1845.
MUNN \& CO., Editors and Proprietors.
pUBLISEED WEEKLY AT
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VoL. XL., No. 3. [Nyw Series.] Thirty-fourth Year.
NEW YORK, SATURDAY, JANUARY 18, 1879.


TABLE OF CONTENTS OF
the scientific american supplement No. 159,
For the Week ending January 18, 1879.
Price 10 cents. For sale by all nemsdealers.







## OVER-DENSITY OF POPOLATION IN CITIEs

The great and growing question as to the dingers, both to life and health, that result from an overcrowding of the population in large cities, has lately received a new treatment at the hands of the learned Dr. Parr, by the labors of whom the subject has been reduced to a science of almost mathematical exactness. In a paper entitled "Density or Proximity of Population, its Advantages and Disadvantages," recently presented to the Congress at Cheltenham, England, by this excellent authority, the statistics shown are somewhat startling, and put forth in such a way as to prove exceedingly interesting and instructive. Dr. Parr's principle is this
" Observe the effects of the population-density; as a rule, the greater this density the shorter the duration of life; and
this life-duration is seen to follow a ratio appreciable by sim ple arithmetic."
'That man by his very nature is gregarious in his habits, and that, following the dictates of his nature, it is his wont to congregate in dense communities, is a fact so well known, and one that has been so often commented upon, as to appear trite in its repetition. We cannot, perhaps, expect to accomplish much in the way of changing his habits in this respect by moral suasion, the best we can do being to exhibit the results that modern science has arrived at in its investigations of the subject of overcrowding, not so much to the sufferersthemselves from this state of things, as to the authorities! whom they have elected to look after their welfare. The gist of the matter is given by Dr. Parr in the following words: "The nearer people live to each other the shorter their lives are, ${ }^{v}$ and the relations of this proximity to the duration of life are ascertained to be as follows:

In round numbers, where we atand on an average 400 feet off from each other, we live on an average 50 years; where we are 300 feet off, we live 40 years; where we come within 60 feet of each other, we live but 30 years; and where we are but 20 feet off, we live but 25 years. It does not seem likely that by extending our interspace beyond the 400 feet we could prolong the average of life beyond 50 years; but it is very clear that if we contract the interspace beyond the limit of 20 feet we must rapidly reduce the mean of 25 nothing 20 , to 15 , to 10 , and before long, so to speak, to with which, in the ordinary circumstances attending such a condition, human life could not be sustained at all; and from this melancholy zero there rises a scale of progression, obeying, of course, a recondite, butintelligible mathematical law, whereby we may measure off in a moment, according to the number of lives per acre, the number of years of life." Again, from Dr. Parr's actual figures we learn that "during the decennial period from 1861 to 1870 inclusive, the deathrate of certain of the most favorably situated districts of England, taken at per 1,000 of the population, proved to be 17 per annum, 16, and even so low as 15 ; whereas in certain other places it stood at 31,33 , and even 39 per 1,000 per annum. He then tells us that in those cases where 16 died in 1,000, each individual had to himself, on an average, 4 acres where 15 died, each had 3 acres: whereas where 31 dicd, each had only one tenth part of an acre on an average; and where 39 died, each had only one one-hundredth part of an acre. The writer then goes on to show that, as regards the intermediate cases, the regularity of the rule is sufficiently pre cise." It further appears that the densest and most unwhole some of the districts in England is Liverpool, where a square
mile holds no less than 63,823 human beings-an average of about one hundredth of an acre to each, or equivalent to a space of 12 by 12 feet. Thus it may be readily seen that if the men, women, and children of the lower order were to be placed on a surface of level country, each person being 12 feet from the next, and if the dirt, destitution, intemperance, and disease, coupled, of course, with the toil of this class, were conditions present in full force, 39 out of 1,000 , or say 1 out of 25 , must die annually. In other words, the average duration of human life must be as low as 25 years.
Such are some of the more important of the interesting facts given us by Dr. Parr in his valuable paper. The Architect, to which we are indebted for an abstract of these conclusions, emarks very truly that " no doubt the local circumstances of any particular community must always exercisc a consid erable influence on the death rate. It is scarcely neces sary to say that it is not so much the crowd that kills, as i is the conditions under which the crowd accumulates; the conditions of soil and climate, of the contamination of air
and water, of the disposal of refuse, of food supply, of the consumption of strong drinks, and of social character and habits in various ways, whether in labor or in idleness." While there is no doubt that such conditions as these exercise a large influence on mortality in large cities, there is also no doubt that the death rates in such communities are pretty certain indices of the perfection or imperfection of municipa rrangements in regard to sanitary matters.
Without pretending to state the cause, we may call attention, in connection with this subject, to the following fact From the figures lately published by the German Imperia Statistic Office, giving the mortality per 1,000 inhabitants in the chief cities of the world, we learn that the death rate in
the city of New York is about one third greater than that of London, and a fraction greater than that of Liverpool, which, as Dr. Parr has shown, is the most unfavorable district in England.

## PATENTS IN NEW SOUTH WALES

A bill to amend the laws relating to patents has been in troduced in the Parliament of New South Wales. It pro
vides for the establishment of a patent offlee, the appoint ment of $\dot{\text { a }}$ " Patents Officer," and the issuing of patents fo inventions, and the publication of the patent specifications Any person may obtain a patent for his invention, giving him an exclusive property therein, provided the invention has not been in public use in New South Wales for more han one year, or has not been patented in any other country more than one year. But if any one in New South Wales shall have begun to manufacture an article before the patent is granted, such person may continue to manufacture and sell such article notwithstanding the patent. The life of a patent is to be five, ten, or fifteen years, at the option of the patentee, the respective fees being $\$ 25, \$ 50$, and $\$ 75$. The Government retains the privilege of using any patented invention on paying to the patentee such sum as the Patents Officer may decide to be a reasonable compensation therefor. Patents are assignable, wholly or in part, the assignment to be registered in the Patent Office. In case of infringements, the Supreme Court adjudges damages and costs.

## SUN SPOTS AND COMMERCIAL CRISES.

To the numerous explanations that have hitherto been given by various writers on commercial topics, to accoun or the present depressed state of trade, there has recently been added another-this time from the pen of Prof. W Stanley Jevons, who, in a late number of Nature, treats the matter at some length from a scientific standpoint.
The fact has iong attracted attention that commercial crises, like the one through which we are passing, are marked by a certain periodicity in their. occurrence, and they have been associated, not unreasonably, to a certain extent with a deficiency of crops, and such deficiencies again have in re cent years been supposed to be in some way connected with the "sun spot period."
Professor Jevons, in his present paper, endeavors to estab lish a direct relation between the latter periods and times of rade depression; and, although his studies have not as ye allowed him to fix the exact nature of the connection, the data that he furnishes exhibit at least some curious coincidences. After some preliminary accounts of what has been done in this field of research, both by himself and others, in former years, Professor Jevons says: "It is impossible in this place to state properly the facts which I possess; I can only briefly mention what I hope to establish by future more thorough inquiry. . . . Deferring, however, for the present, any minuter inquiry, I permit myself to assume that there were, about the years 1742 and 1752, fluctuations of trade which connect the undoubted decennial series of 1711 , 1721, and 1732 with that commencing again in the most unquestionable manner in 1763. Thus the whole series of de cennial crises may be stated as follows: 1701 (?), 1711, 1721, 1731-32, 1742 (?), 1752 (?), 1763, 1772-3, 1783, 1793, 1804-5 (?) 1815, 1825, 1836-9 (1837 in the United States), 1847, 1857, 1866, 1878. A serics of this sort is not, like a chain, as weak as its weakest part; on the contrary, the strong parts add strength to the weak parts. In spite, therefore, of the doubtful existence of some of the crises, as marked in the list, I can entertain no doubt whatever that the principal commer cial crises do fall into a series having an average period of about 10446 years. Moreover, the almost perfect coincidence of this period with Mr. J. A. Broun's estimate of the sun spot period- $10 \cdot 45$ years-is by itself strong evidence that the phenomena are casually connected."
Hyde, Clarke, Wilson, and Danson all argued, 30 or 40 years ago, that commercial fluctuations must be governed by physical causes; but the difficulty that bas beset the theory is that hitherto no one has been able to detect a clear peri odic variation in the price of corn. Sir William Herschel endeavored to do this at the beginning of the present century in his inquiry as to the economic effects of the sun spots: but his facts are too meager to justify any certain inference. Professor Jevons confesses that as yet his own in quiries have been equally without result on this point. "The fact is," he says, "I believe that cereal crops, as grown and gathered in Europe, depend for their success upon very complicated conditions, so that the solar influence is disguised. But it does not follow that other crops in other latitudes may not manifest the decennial period. Dr. Schuster has already pointed out in Nature a coincidence between good vintages and minima of sun spots, which can hardly be due to accident. "Now, if we may assume Dr. Hunter's famine theory to be true, there is little difficulty in explaining the remarkable scries of periodic crises which I have pointed out." The author goes on to show that the trade of Western Europe has always been strongly affected by communication with the Indies, several crises being distinctly traceable to this cause; thus the crisis of 1878 is clearly connected with the recent famines in India and China, and these famines are confidently attributed to solar influence. He states, then, that it is his present belief that to trade with India, China, and other parts of the tropical and semi-tropical regions, must be attributed the principal fuctuations of European commerce, although the decennial fuctuations ought not to be wholly laid to the account of Indian trade; it being quite possible that tropical Africa, America, the West Indies, and even the Levant are affected by the same meteorological influences which occasion the famines in India. Thus it is the nations which trade most largely with those parts of the world, and which give long credits to their customers, which suffer most from these crises. Professor Jevons sees nething in his theory incon sistent with the fact that crises and panics arise from other than meteorological causes; but when such do happen, they
seldom, if ever, have the intensity, profundity, and wide extension of the true decennial crises.
The conclusion which the author draws from his speculation is that "if there is any truth in all these sun spot speculations, there must be a periodic variation in the sun's rays, of which the sun spots are a mere sign, and perhaps an unsatisfactory one. It is possible that the reat variations are more regular than the sun spot variations, and thus may perhaps be explained the curious fact that the decennial crises recur more regufarly on the whole than the maxima and minima of sun spots."
To determine this mooted question, then, he suggests the importance of at once undertaking direct observations upon the varying power and character of the sun's rays; and to this end solar observatories should be established in every country where the sun can be observed most free from atmospheric opacity. If from such observations it be found, as will probably be the case, that the sun does vary, "the time will come when the most important news for the commercial world contained in the Times will be cablegrams concerning the solar power." And he adds that certainly an empire upon which the sun never sets cannot wisely neglect to keep a watch on that great fountain of energy, since "from it we derive our strength and our weakness, our success and our failures, our elation in commercial mania, and our despondency and ruin in commercial collapse.

PROGRESS OF THE SWEDISH ARCTIC EXPEDITION.
There is a strong probability that the Swedish Exploring Expedition, under Professor Nordenskjold, has by this time
proved the existence of an available northern passage from proved the existence of an available northern passage from the Atlantic to the Pacific. In 1876 and 1877, Professor berian rivers Obi and Yenisei by way of the Kara Scal, a feat never before accomplished, thus establishing a new commercial road to the regions which those streams water. During the past summer, the expedition which sailed from Hammerfest, Norway, in July, successfully traversed the Kara Sea in the forepart of August, and arrived at Dickson's port, at the mouth of the Yenisei, on the 6th. Four days later the expedition, comprising two small but strong steamers, the Lena and the Vega, began the exploration of the hitherto untried sea to the north and east. By August 20 , the northernmost point of Asia was passed, and in a
week more the mouth of the Lena was safely reached. Here week more the mouth of the Lena was safely reached. Here
the steamers parted company, the Lena to ascend the river to Yakutsk, the Vega to continue the exploration of the Siberian coast, hoping within a few months to reach Japan by the way of Behring Strait. The greater part of the coast from the Lena to Behring Strait has already been explored by sailing vessels, so that the probability of the successful passage of the Vega is very great. Should it prove feasible to navigate those seas even during a few months of each summer, the commercial advantage of the new route between Europe and Eastern Asia and Western America will be considera ble. Besides, it would open up to trade the northern half of the vast continent of Asia, by way of the great rivers Obi, Yenisei, and Lena.
Professor Nordenskjöld has already shown that trading vessels carrying protitable cargoes can reach the north of the Yenisei in August and September, and return with marketable freight before the Kara Sea is closed by ice. Should the entire route by way of the Arctic Sea provepracticable, the summer voyage from Europe to the East would be shortened about one fourth; but that advantage would be offset by the disadvantage of being closed•by ice ten months in the year.
In any case the new Siberian regions opened up are likely to prove of great benefit to Europe, both in furnishing large supplies of food stuffs and raw materials, and in offering a market for manufactures. Siberia has made enormous progress in material development during recent years, and improved trade connections would give a great impetus to the new settlements. Fortunately American manufactures are highly esteemed in Siberia; and if a proper effort is made a large share of the new trade may fall to us. On the other hand Siberia is likely to become a serious rival to us as a
producer of breadstuffs. Vast regions there are admirably producer of breadstuffs. Vast regions there are admirably
suited for the cultivation of grain; and they will make themselves felt in the markets of the world as soon as means are provided for transporting the crops cheaply.

## the trademarks quandary.

The attempts to better the law of trademarks by statutes have evidently muddled the subject. A Maryland judge has pronounced the law of Congress unquestionably constitutional; and jurists will generally agree that, if it is so, it has superseded State laws. But a $W$ isconsin judge is just as clear that the National law is a nullity; and one consequence of this decision, if sustained, would be that State laws are revived. Meanwhile the manufacturer cannot know under which law to act.
Before either law was passed courts of equity had built up a somewhat vague yet efficient system for perfecting the peculiar labels, unique designs, characteristic names, and fancy catchwords adopted by various manufacturers and dealers. Every producer of an article generally known to be good sets a value on the trademark with which it has become associated in the public mind, and will resist the employment of it by his competitors. The courts have sustained these claims; not so much, however, in the view that a trademark is property, as upon the ground of protecting the public from imposition. Any man may make and sell
cologne or cocoa oil, pencils or piano-fortes, shawls or shirts labels of old and distinguished dealers, the public are liable labels of old and distinguished dealers, the public are liable
to be deceived. For the sake of the public the courts will stop such imitations by injunction, and if doing so also protects a meritorious manufacturer in the slowly-acquired reputation of his wares, so much the better. This was the old equity doctrine of trademarks. But it was a long and difficult inquiry, in many of these cases, which of the rivals was first in the use of the disputed name or emblem. To relieve this difficulty, to supply proof of the original ownership and use, is a leading object of the trademark statutes. Such statutes have been passed in England, by the Legislature of New York, and by Congress. They enable a dealer when he first adopts a trademark to register it as his own; and baving done this, he can at any time appeal to the public record to establish his priority of design. Conversely, any one proposing to adopt a trademark can ascertain from the record whether the same design has been appropriated. Our people have Jittle concern with the English law; it is the confusion between State and National laws which nceds remedy. The first National law appeared in 1870, as one chapter in a newly enacted revision of all the laws pertaining to patents and copyrights. This juxtaposition of subjects gave the impression that the law rests upon the power of Congress to secure to authors and inventors the exclusive right to their respective writings and discoveries. And now the objection is made that a trademark is not a writing or a discovery, and its designer is neither an author nor an inventor. Therefore the Iaw is unconstitutional.

The objection is forcible. but an answer is offered that trademarks pertain to commerce, and that Congress has power to regulate commerce. Opponents of the law reply that it is commerce among the States which Congress may regulate, while trademarks belong primarily to domestic commerce, which Congress cannot control. Friends of the law contend that the National Government may make treaties, and treaties may properly stipulate for mutual protection of trademarks of subjects of one government within the dominions of another, and therefore Congress may pass treaties. And so the discussion slowly proceeds, with the effect of creating the dilemma that claims founded on either law may, at any moment, be adjudged invalid. For the power of Congress, if it exists, is exclusive; if it is disproved, then and then only are State laws operative. The New York Tribune, from which we select the above, con-
cludes with everybody else interested in the matter, that the subject deserves early and final determination.

## HOW TO UTILEE OLD FRUIT CANS

Perhaps one of the most appropriate uses of an old fruit can hat can be devised is to make it contribute to the growth of new fruit to fill new cans. This is done in the following manner: The can is pierced with one or more pin holes, and then sunk in the earth near the roots of the strawberry or tomatoor other plants. The pin holes are to be of such size that when the can is filled with water the fluid can only escape into the ground very slowly. Thus a quart can, properly arranged, will extend its írigation to the plant through a period of several days; the can is then refilled. Practical trials of this method of irrigation leave no doubt of its success. Plants thus watered flourish and yield the most bounteous rfturns throughout the longest droughts. In all warm local ities, where water is scarce, the planting of old fruit cans, as here indicated, will be found profitable as a regular gar dening operation.

## SENATE BILL 300.-SECTION 2.

In all discussions of patent rights with reference to Mr . Wadleigh's bill for the amendment of the patent law, it is needful to bear in mind the broad principle that Congress is empowered by the Constitution to grant to inventors the "exclusive" right to the manufacture and sale of the article or process patented. The right is limited in time, but it cannot be limited in scope. In other words Congress has: no power to come between the patentee and his invention, to say what he shall do with it. Whether this provision of
the Constitution is wise or not is beside the question. In our opinion it is eminently wise; but wise or foolish, there it stands, and can be got rid of only by an amendment of the Constitution, not by any change in the wording of the patent law.
The fatal objection to Section 2 of Mr. Wadleigh's bill is that it undertakes to limit the scope of the patentee's right. It provides that if the patentee chooses for any reason to share his right with $\mathbf{A}$ and $B$, giving them a hicense to use his invention or discovery, C, D, and all the rest of the alphabet may come in and enjoy the privilege on the same terms. Still worse, if the patentee elects to retain the en tire control of his invention, his purpose may be thwarted, the penalty for the infringement being a license 1 ee " determined from all the evidence in the case."

The purpose of the American patent law is to encourage the advancement of the useful arts through invention and discovery. Its object is to induce men to study and experiment and invent; and it seeks to accomplish that object by the hope held out to the inventor that by the enjoyment of the exclusive right to the manufacture and sale of a pat fortune than would be otherwise possible. Once secured patented invention is property, to be respected as other property is. The Constitution provides that during the life of
the patent the owner of it shall be free from dictation or in terference; so long, of course, as he uses it without direct injury to himself or others. In other words, his right is as exclusive as his right to a horse or a gun, or a house that he has reared or bought or made.
What would be thought of the wisdom of a legislative body which should enact a law to the effect that in case $A$ lends his horse to $B$, for friendship or hire, any other man might use the horse on the same terms? Or in case $A$ should decline to lend his horse, B's unauthorized use of the animal would be punishable only by the payment of the customary license fee of the livery stable? Similarly if A allows $B$ to plant a potato patch in the corner of his farm, the whole farm shall be laid open to invasion on the same terms? Or if C wants to occupy a room in D's house he shall be allowed to do so on payment of such rental as some one else shall decide to be sufficient?
Is there any less absurdity or injustice in making parallel provisions with respect to invasions of patent rights?
As a rule it may be said that the work of inventing a novel and useful device is less arduous and costly than the work of introducing it. As a rule, too, the inventor is very apt to be without the means needful to develop and intro duce an invention so as to make it pecuniarily profitable. Accordingly very favorable terms may well be offered to he first to take hold of and work up a new invention. The risks are great, and the promise of ultimate profit should be correspondingly great. Would any cautious business man be willing to assume such risk if he knew that when the profitableness of the invention came to be successfully de monstrated, any one else could step in and use the perfected invention at no greater risk than the payment of a license The great trouble with the framers of devices for facilitat ng the invasion of patent rights, like this second section of Mr. Wadleigh's bill, arises from their proneness to forget he grand purpose of the American patent system-the ad vancement of the useful arts by the encouragement of inven tion-and the not less vital point that the only means for the attainment of that end contemplated by the framers of the Constitution was the recognition of the inventor's exclusive right to the control of his invention or discovery during the period for which the patent should be granted.
It would no doubt be very pleasing to such as are or desire to be infringers upon patent rights, to have the inven tor's exclusive right laid open to invasion. But the patent law was not framed to meet the wants of infringers, and Congress has no constitutional power to alter it in their favor.

## BOILER FEEDERS FOR LOCOMOTIVES, ETC.

Among the improved appliances in this line proven by practical tests to possess superior merit, the Hzncock Inspi rator may be especially mentioned. The company's business announcement will be found in our advertising columns. The performances of this apparatus are in some respects re markable. E. Howard \& Co., the well known watch and clock makers, have one in use which they say draws the water from a driven well, some 75 feet distant, and a per pendicular lift of 20 feet, and also forces the water, when needed, 70 feet up into a tank at the top of the building.
For locomotives they are especially useful. Mr. James K. Taylor, master mechanic of the Old Colony Railway, states that every one of twenty-three of these feeders, now in use on the locomotives of the above company, is giving great satisfaction. Not one has had to be taken off for repairs. They supply all the water required by the engines, are found more reliable and economical than any pumps, which latter they do not hesitate to remove. They are more positive in working, less liable to clog, have greater range than any other device, and require less attention from the engineer in working them. Practical indorsements of this sort are worthy of the highest consideration.

## An Economical Engine

A compound ccndensing pumping engine, erected for the Buffalo (N. Y.) High Service Water Works, by the Holly Manufacturing Company, of Lockport, N. Y., recently tested under the supervision of Professor Greene, President of the Troy Polytechnic Institute, developed a duty of 80 ,489,638 foot pounds per 100 lbs . of coal. Following are the elements of the test:
High pressure cylinder, 1, diameter, inches Low pressure cylinders, 3, diameter, inches. Double-acting pump cylinders, 4. diameter,
Length of stroke of each cylinder, inches. Tota number of revolutions.
Duration of test
Revolutions per minute.
Piston speed per minute, in feet.
Pressure on water gauge, in pounds
Pressure from reservoir supply, to be deducted
in pounds....
in pounds..
Actual water pressure, or load on the pump, in lbs.
Coal consumed, no deductions, pounds.
Vacuum, inches. .

grees, Fah injection water to air pumps, de-
Temperature of water in hot well, degrees, Fah..
Temperature of feed water to boilers, deg., Fah.
pumps, two single acting, diameter, 24 in .
stroke, 30 in .
Suction and discharge pipes, diameter, 24 in .
Fly wheel, diameter, $12 \mathrm{ft}$.4 in.
Fly wheel, diameter, 12 ft .4 in .; weight, 7 tons.
Duty in foot pounds, per 100 pounds of coal. .. . 80,489.638
This engine is similar to that described in the Scientific
This engine is similar to that described in the Scientific
American, vol. $x \times x i x$. , p. 95, and in Supplement No. 140.

