gregate capacity of about 8,000 lamps. Dynamos and engines are on the same floor, every part of which is constantly under the eye of a single attendant. Both engines and dynamos stand on brick foundations, the floor itself being of cement. Each engine is belted direct to its dynamo, no power being wasted in transmission; and the subdivision of power enables the wide fluctuations of load to be met by stopping and starting any engine and dynamo as needed, thus operating the whole station under the highest possible economical conditions at any moment. The steam-pipe is brought along the engine-room overhead, and the engines exhaust into a main laid in a covered trench underneath the floor, every part being accessible. All drips and overflows are run into a sewer. Two exciting dynamos are provided, as shown on the left of the dynamo-room, each adequate to supply current to the fields of all the alternating dynamos of the station, and each driven independently by its own engine. But one engine and exciter is therefore run at any time, the other standing ready as a relay in emergency. Moreover, the position of the engines and exciters is such that by changing a belt either engine can drive either exciter, and thus the chance of possible stoppage is reduced fourfold. The Westinghouse Company regard this latter arrangement as representing the best possible engineering, and strongly urge it upon every station of any considerable magnitude. Two overhead travelling-cranes traverse the whole length of the building over the engines and dynamos.

In a station so arranged, the labor is reduced to a minimum. With natural gas, of course, but one fireman is required; firing with coal, two firemen will be on duty in the first run of the evening, and one in the second run. But one attendant is required in the dynamo-room at any time, the lightness of his duties permitting him to give all necessary attention to the engines, dynamos, exciters, and switch-board. It is obvious that this general plan can be advantageously followed in most instances.

COAL-MINING MACHINES OPERATED BY ELECTRICITY.

THERE has probably been no greater advance in the mining-field effected during the past decade than the general introduction of electricity for power and lighting purposes.

The advantage of using electricity, its simplicity, compactness, safety, cleanliness, and reliability over the use of steam for power, were early recognized by mining engineers, and electricity is now generally regarded as the most convenient agent at the miner's disposal for transmitting his power into the interior of the mine.

One of the newest and latest applications of electric power to mining-work can be seen daily in operation at Mr. T. C. Heimes's "Drane Colliery," near Osceola, Clearfield County, Penn. Here a most interesting application of motors for mining-work has been devised by Mr. F. M. Lechner for operating a coal-cutter by electricity.

Mr. Lechner is well known as being not only the first inventor of coal-cutting machinery, but also the first to operate compressed air in mines for this purpose. His long practice and experience in the coal-mining field have made him familiar with all the difficulties attending the use of machinery in mining-work, and, ever since electric power has been in use for industrial purposes, he has made a study of the problems in adapting electric power to this work.

It soon became evident to Mr. Lechner that the best results could only be obtained by operating the motor and cutter apart, as otherwise the size and weight of the cutter with the motor mounted upon it would prevent its easy transportation in the mine.

In order to do this, the following arrangement has been adopted in the mine before mentioned, and has proved very successful. The motor, which is a 10 horse-power of the Sprague type, is mounted upon a truck running upon rails, so that it can be very easily handled and hauled from one position to another, as occasion requires. The entire weight of the motor is less than 1,000 pounds.

The cutter operated by the motor, which in this case is the "New Lechner," is set in position in the room to be cleared, and is connected with the motor by a five-eighths inch rope belt, running in V-shaped grooved sheaves, one being on the motor, and the other on the cutter.

This connection is long enough to allow the motor to be operated 30 feet away from the cutter, and the motor has been set in a position in this mine 1,600 feet away from the dynamo. The motor is held in position by guys at the point of use.

By means of screw-jacks that can be easily adjusted to any height, with loose sheaves upon them, the cutter can be operated at any angle from the motor; and the connection is made taut by moving the truck upon which the motor rests, and securing it in the right position by guys.

All mining engineers are familiar with the difficulty attending the working of the cutters in the limited space generally allotted them in mines, and know how essential it is to have every machine divested of every pound of surplus weight. They also know what care must be exercised in moving it with great iron crowbars, to prevent injury to the more delicate parts of the engines; and, however careful, how frequent it is that connecting rods and other parts are so impaired that the machine has to be sent to the shop; then how the rugged action of the engines shakes every thing loose on the machine, however firmly they may appear to be adjusted. All this is removed by the absence of the engines, the machine running as smoothly as a buzz-saw, and, as a consequence, cutting with the same facility. By this plan, three machines can be operated by one motor; for, when one room is cut, the motor can at once be hauled to another room, where a machine is in readiness and position, cut that room, and pass to a third while the coal is being removed from the first two, and the cutters being again placed in position.

It was found, upon a preliminary trial of this apparatus at the Osceola Mines, that by its use two men are able to excavate 100 tons in 10 hours, and that they can move the cutter as often as desired without any auxiliary aid.

The efficiency of both dynamo and motor is over 90 per cent; so that, allowing 10 per cent drop on the line, nearly 73 per cent of the power delivered to the dynamo-pulley can be depended upon at the motor for work.

It has been estimated that the cost of equipping a mine for the purpose of operating machinery with electricity is only about one-half the cost of equipping it with compressed air, and the price of maintenance shows about the same proportion of saving.

HEALTH MATTERS.

The Germ Theory in Consumption.

"WHAT Changes has the Acceptance of the Germ Theory made in Measures for the Prevention and Treatment of Consumption?" is the title of an essay by Dr. Charles V. Chapin of Providence, to whom was awarded a premium of two hundred dollars by the trustees of the Fisk Fund. In this essay Dr. Chapin has given an admirable *résumé* of all that has been written about consumption from the time of Hippocrates to the present day. After a careful examination of the literature of the subject, he thinks that we are justified in the conclusion that the acceptance of the germ theory has made no direct or important addition either to the hygiene or medicinal treatment of consumption. He thinks, however, that it should have great influence. It tells us plainly what we ought to do. We simply do not obey its behests. The germ theory — now no longer a theory in the case of tubercular consumption — tells us that we have to do with a contagious disease. Now, there is no theoretical reason why a purely contagious disease like tuberculosis cannot be exterminated. If we can prevent the spread of contagion at all, we can prevent it entirely. The enormous value of preventive measures, isolation, disinfection, and quarantine, is well illustrated in the history of cholera, typhus-fever, and yellow-fever in the United States. By keeping out the virus of these diseases, or destroying it when it had gained access to our shores, we have for a number of years been remarkably free from these diseases, and it is certain that if these precautions had not been taken we should have suffered severely. For obvious reasons the suppression of tuberculosis is not so easy a matter as the suppression of cholera or yellow-fever. Neither is the suppression of scarlet-fever or small-pox as easy. Yet wherever the public have been educated to a correct appreciation of the contagious nature of scarlet-fever, the number of cases has diminished very much. Even in small-pox with its virulent contagion, it is possible, by means of isolation and

disinfection, to check its spread even among an unvaccinated population, as has been illustrated many times of late in the anti-vaccination city of Leicester, England. We must now put tuberculosis among these diseases, and, though its theoretical suppression is simple, its actual extermination is a very difficult problem. It lies largely with the medical profession how long tubercular disease shall decimate the human race. The physicians are the educators of the people in these matters. When the doctor shall teach that tuberculosis is contagious, the people will believe, and will govern themselves accordingly. In combating contagious diseases the preventive measures taken often give discouraging results. This will be particularly so in tubercular disease. Halfway measures secure less than halfway results, and these alienate the support of those who only indifferently believe in contagion and the importance of precautionary measures. Efficient means of suppression are radical, and bear hard on the individual: they are not complied with, and they produce violent opposition. Yet, difficult as it may be, the medical profession should take aggressive action against this disease. We have no right to wait for the discovery of a specific, or the gradual evolution of a phthisis-proof race. We must take the world as we find it, full of men and women predisposed to tubercular phthisis, and with no idea of its contagious nature. What can we do about it?

1. Teach the people the true nature of tuberculosis; that no one ever has tubercular consumption unless the tubercle bacilli find their way into the lungs.

2. Teach them also, that, even if it finds its way there, it will not grow unless the conditions are right. Teach fathers and mothers how to rear healthy boys and girls. Tell them what to eat and what to wear, to exercise, to breath fresh air. This alone would exterminate phthisis.

3. The contagion must be destroyed. Fortunately in this disease there is no need of isolation. Disinfection is enough. The consumptive patient gives off the poison only in the sputum, or perchance the other excreta, if the disease extend beyond the lungs. The virus is not given off from these while moist. We must therefore disinfect all sputum at once with mercuric bi-chloride. Cloths must be used instead of handkerchiefs, and then burned; or, if the latter are used, they should be often changed, and immediately put in a bi-chloride solution and boiled. Bed-linen should be treated in the same way. Frequent disinfection of the entire person, and fumigation of the apartment, would be safe additions to the preventive measures.

4. Persons who have a marked predisposition to the disease had best not come in close contact with the phthisical. Children should never have tuberculous nurses, wet or dry. In the case of consumptives very great attention should be paid to ventilation, and to the alimentation both of the patient and the attendants.

Such measures, if rigidly carried out, would be of enormous service in preventing this disease. But with the increasing prevalence of tuberculosis among domestic animals, something more is imperatively demanded. Active measures should be taken to free the country from animal tuberculosis. The proper authority for dealing with this, as with all other contagious diseases of animals, is the Bureau of Animal Industry of the Department of Agriculture. It is a wasteful method for States to act independently. The powers and expenditure of this bureau should be greatly increased, and it should take active measures against this disease. The exact measures suggested are, —

1. The reporting of all cases of tuberculosis in domestic animals to the proper authority, by both owners and veterinaries, or other persons having a knowledge of the same.

2. The slaughter of all infected animals, and the isolation and slaughter of all exposed to infection. The government should partially indemnify all owners of slaughtered cattle.

3. Thorough disinfection of all buildings occupied by diseased cattle.

4. The confiscation of the flesh and milk and milk products of all tuberculous animals.

Pasteur's Method.

"Pasteur's method hardly attracts any attention now, and seems to be in a fair way to die a natural death." Such is a statement made by Dr. Charles W. Dulles, in his report on hydrophobia to the Medical Society of the State of Pennsylvania. In support of this statement, he quotes from a report of Dr. Dujardin-Beaumetz to the effect that there were nine deaths from hydrophobia in Paris during 1887, which was more than in 1880, 1883, 1884, or 1886. Five of these deaths were of persons less than fifteen years old. In one of the cases the patient was not bitten at all, but was simply licked on an abraded spot. Eight of the patients were bitten by dogs, and one by a cat. Two of the nine patients had been treated by Pasteur; and their death is explained by Dujardin-Beaumetz on the ground that his method was not thoroughly carried out. The total number of persons treated by Pasteur was only 306 persons from Paris, bitten by dogs supposed to be rabid, as against about 300 a month one year ago.

These facts, Dr. Dulles thinks, show two very important things. One is, that the application of Pasteur's method has had no effect in reducing the usual mortality from so-called hydrophobia in Paris, which confirms the opinion in regard to its merits which he has repeatedly expressed; the other is, that, in spite of the artificial stimulus furnished by the French reception of Pasteur's method, the number of those who fall into the terror of hydrophobia is diminishing in France, and this leads to the hope that before long France will compare favorably with Germany and America, which have refused to be carried away by the false notions in regard to hydrophobia put forward by one who knows nothing about it but what he has manufactured in his laboratory.

There is a great significance in the fact that disbelief in the theories of Pasteur, which some of his partisans have stigmatized as harsh or unscientific, has been found to go with a singular immunity from the ravages of so-called hydrophobia. This holds true to such an extent that one may safely say that the degree of acceptance of Pasteur's theories in any country will furnish a measure of the number of cases and deaths from hydrophobia. In Germany these theories have never obtained a foothold, and hydrophobia is almost unknown: in America the attempt to import them ended in speedy failure, and here hydrophobia is almost equally unknown.

A detailed account of fifteen fatal cases of hydrophobia is given by the author of the paper. Attention is called by him to the following points, which are brought out in a study of these cases: —

1. *The Effect of Anticipation of Hydrophobia.* — This is said to have been present in seven of the fifteen cases, and may be suspected in more.

2. *The Lack of Evidence of Rabies in the Animal which did the Biting.* — Not one of the animals furnished more than ground for a suspicion that it was rabid. The fact that a fighting dog bites a man who interferes with it, is no evidence that it is rabid, nor is the manifestation of a vicious temper a good evidence of rabies. The same may be said of death in a fit.

3. *The Effect of a Diagnosis of Hydrophobia.* — In ten of the fifteen cases it is stated that the physicians made an early diagnosis of hydrophobia, and presumably they failed to conceal the fact from the patient.

4. *The Effect of applying the Test of the Water.* — This is said to have been done in seven of the fifteen cases, and it was probably done in almost all of them.

5. *The Assertion that Canine Symptoms were Present.* — Five of the patients are said to have whined, or howled, or snapped, or bitten at their attendants.

6. *The Frequency of Forcible Restraint.* — This is said to have been employed in eight of the cases.

7. *The Uselessness of administering Narcotics.* — Powerful narcotics are said to have been used in ten of the cases, and they were probably used in all. Curare is said to have been used in four cases.

In concluding his report, Dr. Dulles says, "I have on several previous occasions declared my belief that hydrophobia is not a specific inoculable disease. I believe this more firmly to-day than ever before. I do not deny that men and women and children sometimes fall into a peculiar state after a dog-bite, and die in due time; but I do deny that this is attributable to any specific virus in the dog's saliva. The same thing has occurred too often from other causes to justify one in charging it to a specific virus when it

ollows a dog-bite. And I believe that the rejection of the specific theory will do more to banish hydrophobia from the world than any thing which we have ever heard of.

"The word 'hydrophobia' should be used only to describe a condition, and not a disease, as we use the word 'convulsions;' and it should be remembered that this condition may be present in a great number of diseases, as I tried to show you when you last met in this city, in 1884.

"I firmly and honestly believe, that, if this view of what is called hydrophobia were generally accepted, the disorder would shrink and disappear, as the geni is said, in the tales of the 'Arabian Nights,' to have shrunk and disappeared when the right word was spoken; and I call your attention to the fact that hydrophobia is now almost unknown in our own State of Pennsylvania. Not a single case has occurred in our State since we last met, and I cannot but attribute this fact partly to the extent to which your judgment confirms the opinions to which my studies of hydrophobia have led me.

"I do not despair of seeing the belief in hydrophobia follow the belief in witchcraft, which once had the support of Church and State, of the medical profession and the laity, but which now, thank God! torments our fellow-men no more. So long, at least, as Pennsylvania presents the spectacle of freedom from the thraldom of ancient superstitions in regard to hydrophobia, and freedom from its curse, I cannot but think that the former has some causal connection with the latter."

INEBRIATE ASYLUMS.—Dr. T. D. Crothers of Hartford, Conn., in an address on "Inebriate Asylums and their Work," delivered at Toronto, Can., draws the following conclusions as being supported by the latest teachings of science and experience: 1. Inebriate hospitals must take the place of jails and station-houses. Such places are dangerous in their mental and physical surroundings, by intensifying the degeneration, and removing the patient beyond hope of recovery. They are in many cases literal training-stations for mustering in armies of chronic maniacs that never desert or leave the ranks until crushed out forever. 2. Inebriate hospitals should receive the incurable inebriates, and make them self-supporting, and build them up physically and mentally. They would relieve the tax-payer, and relieve society of untold burdens of sorrow and misery. 3. Inebriate hospitals should receive the recent cases, and place them in the highest conditions of enforced health and vigor, and thus return a large number to health and sobriety again. 4. Inebriate hospitals can and should be self-supporting when once established. They should be managed on scientific business principles, like military training-schools. 5. Inebriate hospitals should be built from the money raised by taxes on the sale of spirits, on the principle that every business should be obliged to provide for the accidents which grow out of it. 6. These are the realities which every inebriate hospital is approaching, and which all experience points out as practical and literal in the near future. 7. The inebriate hospitals of to-day are only in the infancy of their work, contending with great opposition and prejudice, misunderstood, condemned, and working against innumerable obstacles. 8. The work of the present inebriate hospitals, notwithstanding all the difficulties and imperfections, has the grandest promise for the future, and encouragement for further effort in this field, along the line of scientific research. 9. Lastly, there is an intense personality in inebriate hospitals to each one of us. They may bring salvation and restoration to some one near and dear. They may be fountains of healing whose influence shall cross and influence our pathway in many ways. 10. Inebriate hospitals and their work is the great new land which only a few settlers have reached. They are calling to us to come up and occupy, and thus help the race on in the great march from the lower to the higher.

THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

THROUGH the efforts of Mr. George F. Porter, of the transportation committee, one and one-third rates were obtained some time ago for all delegates travelling to the coming convention in Chicago, in the territory of the Trunk Line Association. It gives us pleasure to now announce that the same active worker has secured the same rates from the Central Traffic Association, whose territory covers all that portion of the United States lying west of Pittsburgh (Penn.), Buffalo (N.Y.), and Bellaire (O.), and north of the Ohio River and east of Chicago (Ill.). The method of obtaining the return ticket from the Chicago Convention (Feb. 19, 20, and 21) is extremely simple.

First, Each person must purchase (not more than three days prior to the date of the meeting nor later than three days after the commencement of the meeting) a first-class ticket (either unlimited or limited) to the place of meeting, for which he will pay the regular tariff fare, and upon request the ticket-agent will issue to him a certificate of such purchase properly filled up and signed by said ticket-agent. Second, If through tickets cannot be procured at the starting-point, the person will purchase to the nearest point where such through tickets can be obtained, and there repurchase through to place of meeting, requesting a certificate properly filled out by the agent at the point where repurchase is made. Third, Tickets for the return journey will be sold by the ticket-agents at the place of meeting at one-third the highest limited fare, only to those holding certificates signed by the ticket-agent at point where through ticket to the place of meeting was purchased, and countersigned by the secretary or clerk of the convention, certifying that the holder has been in attendance upon the convention. Fourth, It is absolutely necessary that a certificate be procured, as it indicates that full fare has been paid for the going journey, and that the person is therefore entitled to the excursion fare returning. It will also determine the route *via* which the ticket for return journey should be sold; and *without it no reduction will be made*, as the rule of the association is that "no refund of fare will be made on any account whatever, because of the failure of the parties to obtain certificates." Fifth, Tickets for return journey will be furnished only on certificates procured not more than *three days* before the meeting assembles, nor later than three days after the commencement of the meeting, and will be available for continuous passage only; no stop-over privileges being allowed on tickets sold at less than full fares. Certificates will not be honored unless presented within *three days* after the date of the adjournment of the convention. Sixth, Ticket-agents will be instructed that excursion fares will not be available unless the holders of certificates are properly identified, as above described, by the secretary, on the certificate, which identification includes the statement that one hundred or more persons, who have purchased full-fare tickets for the going passage, and hold properly receipted certificates, have been in attendance at the meeting. The certificates are not transferable, and the signature affixed at the starting-point, compared with the signature to the receipt, will enable the ticket-agent to detect any attempted transfer. This convention will undoubtedly be the largest and most interesting which has ever been held, and will be accompanied by an exhibition of electric light and power apparatus and supplies, which will be in a large hall devoted entirely to this purpose.

Electric light and power men who are not now members of the association would do well to join at once, which they can do by addressing the secretary, Allan V. Garratt, at 16 East 23d Street New York City.

So large a number of the representative manufacturers and dealers in the electric light and power apparatus and supplies have expressed a wish that facilities be afforded them to make a very large exhibit at the coming convention of the National Electric Light Association in Chicago, in February, that the executive committee has decided to secure a large hall, where ample room for each exhibiter may be had. Before the committee can proceed further with the matter, it will be necessary to know how many exhibiters there will be, how many square feet of floor space each will want, how many horse-power in steam, how many horse-power from shafting, and how much current and at what electro-motive force. For the purpose of the committee at present, it will only be necessary to have an approximate idea of what is wanted: therefore any intending exhibiters should apply at once to Mr. B. E. Sunny, chairman executive committee, 148 Michigan Avenue, Chicago, Ill.

GINN & CO. announce that the new edition of Lanman's "Sanskrit Reader" is ready.