Correspondence.

Cast Iron Field for Motor 641.

To the Editor of the SCIENTIFIC AMERICAN:

I notice in the notes and queries of the SCIENTIFIC AMERICAN that many readers ask if the motor No. 641 would work with a cast field. I have made the motor No. 641 with a cast field and a drum armature with a two layer winding. I also made a copper bar commutator. The motor works fine and has lots of power. I advise any one not to make it for a dynamo. I would advise them to make a dynamo two-thirds the size of the dynamo in the SUPPLEMENT No. 600, as it is a good size for experiments generally, and will be found to work satisfactorily. ROY A. CRIHFIELD.

Lincoln, Neb.

[The cast iron fields will answer for a motor, the all important point being that the armature core shall be laminated. One object of the thin band construction was to avoid the necessity of calling upon the foundry for special castings—to give a design for a home-made motor.—ED.]

The Utilization of Water Power by Electric Transmission.

BY WILLIAM BAXTER, JR.

Every one who is familiar, in a general way, with the operation of electric currents realizes that they afford a means for the transmission of power over great distances at a moderate expense, and therefore believes that eventually, through this agency, every water power of any magnitude will be made available. There are very few, however, who do not labor under the impression that this phase of electric development is still in the experimental stage. The only work in the line of water power transmission that has come prominently before the public is that of the Niagara enterprise. This has attracted worldwide attention, owing to the magnitude of the power available, the general belief being that in the course of time the energy supplied from that source will be counted by the hundreds of thousands, if not by the millions, of horse power. This undertaking is generally looked upon as an experiment, a sort of crucial test, that will determine whether electric transmission can be made successful with our present knowledge of the science or whether we shall have to wait until some time in the future when, by further development, the barriers that block the way to the attainment of our ends may be removed. Such impressions, however, are entirely wrong; the experimental stage of long distance power transmission has been passed, and at the present time the manufacture of machinery for this branch of the electrical industry is of as much importance, if not more, than any other branch, and the indications are that in the very near future it will become as important as all the others combined.

It may prove a surprise to many to learn that work in this line has been carried on, more or less extensively, since 1892. In that year one of the large electric manufacturing companies installed about fifteen thousand horse power of water power transmission apparatus. Last year the business of the same concern, in this line, was about sixty thousand horse power.

One of the first installations of magnitude was that of the Hartford Electric Light Company, which was commenced in 1892. The capacity of this plant is over 1,500 horse power, and the power is transmitted over a distance of about eleven miles. Among the large plants installed since that time may be mentioned one at Sacramento, Cal., which has a capacity of nearly 11,000 horse power; one at Plezer, S. C., of 7,600 horse power; Salt Lake City, about 7,000 horse power; Columbia, S. C., 4,230 horse power; Bakersfield, Cal., 3,420 horse power; Montreal, 12,000 horse power; Ogden, Utah, 11,000 horse power; Hookset, N. H., 3,000 horse power; Fresno, Cal., 2,300 horse power; Portland, Ore., 4,600 horse power; Minneapolis, Minn., 12,000 horse power, and several others.

These plants, as will be noticed, are all of large capacity, and represent in the aggregate nearly 80,000 horse power. There are a great many smaller installations, ranging from 2,000 down to as low as 50 or 60 horse power, thus showing that this form of power transmission is not limited to large units. The total number of water power plants now in operation, or in process of construction, cannot be ascertained with accuracy, but it is known that there are over two hundred light, power, and electric railway stations that depend exclusively upon this source of energy, and many others in which it is used in connection with steam engines. Water powers, as is well known, are not uniform; the flow of water varies at different periods of the year, and in some instances the variation between the maximum and the minimum capacity may be as much as 60 or 70 per cent. When the minimum power is sufficient to meet the requirements, a water plant alone is used, but in other cases it is supplemented by a steam plant, the latter being brought into requisition as fast as the water supply falls short. In some cases even the maximum capacity of the water power is not sufficient to meet the requirements, so that at all periods of the year steam has to be used. In these composite plants the total capacity of the water power at all seasons of the year is fully utilized, and the steam engines are used to supply only the difference between the energy thus obtained and the total amount required.

What has been accomplished so far demonstrates conclusively the feasibility of transmitting power over long distances on a commercially successful basis. At Sacramento, Cal., the distance of transmission is 22 miles; at Fresno, Cal., it is 35 miles; at Ogden, Utah, 36 miles. The distance from Niagara to Buffalo is 21 miles, which is less than the distance in either of the three cases above cited; therefore, there can be no doubt as to the success of transmission in the latter case, so far as the engineering features are concerned.

Heretofore there has been some doubt in the minds of engineers as to the practicability of long distance transmission, because it was doubted whether an electrical pressure sufficiently high to reduce the cost of copper in the conducting lines could be used successfully, but it has been shown by the actual operation of the installations already named that there is no difficulty to be encountered in this direction. In a large number of cases the pressure of the line current is 10,000 volts, and in Ogden, Utah, 15,000 will be used. With such pressures, the cost of transmission lines can be reduced to a point well within permissible limits, for distances as great as twenty-five miles, and where the price of fuel is high enough to increase the cost of steam power to a point that will justify a greater loss of energy in the line, the distance can be considerably increased. There is no reason to believe that in a pressure of ten or fifteen thousand volts we have reached the limit. If this can be handled successfully now, it is more than probable that before long twice as much will be within the possible range, and such an increase in pressure simply means that the thirty and thirty-five miles over which power is now transmitted will then be increased to sixty or seventy miles.

The future development along the line of water power transmission promises to be very great, from the fact that there is so much power to transmit. According to a section of the United States census of 1880, devoted to the water powers of the United States, the energy of this kind available runs up into the millions of horse power. Some fifty-odd power sites that are described have a combined capacity of over 500,000 horse power.

The development for some years to come will no doubt be in the direction of utilizing large water powers, but eventually, as the cost of apparatus and the installation is reduced, smaller ones will be taken up, and perhaps the day is not far off when every farmer who has a power of ten or more horse power on his premises will harness it, and do with it the work now performed by animals or agricultural steam engines.

Railways in Chile.

Although Chile is still deficient in the important matter of easy, rapid, and economical means of communication and transport within her own borders, this question, which is of such great importance, does not appear to have been ignored by the authorities, says the Railway Review. According to a recent Chilean report, since the first railway was inaugurated, in 1851, iron roads have multiplied, and railroad extension has progressed to such a degree that the union of Valparaiso and Puerto Monti by rail has been brought within a readily measurable distance of time.

The great trunk line has prolonged from time to time until it has been found necessary to divide it, for the purpose of administration, into three sections, to which there will probably be added, at no very distant day, a fourth. The first section comprises the line from Valparaiso to Santiago, and includes the branch from Las Vegas to Los Andes; the second comprises the line from Santiago to Talca, and includes the Tinguirirca and Palmilla branch; while the third comprises the line from Talca to Victoria, and includes the Angeles Traignen and Talcahuano ramifications. The total length of the first section is 228 kilometers (kilometer = 0·621 of a mile), of the second 296, and of the third 582, or a total of 1,106 kilometers.

At the end of 1895 the condition of the state lines in course of construction was officially reported to be as follows: Vilos, Illapel, and Salamanca line, of 102 kilometers in length, has suffered many delays, but the Calibolen tunnel is finished as far as piercing is concerned. Work was also suspended for some time on the Ovalle and San Marcos line, but operations were recommenced on the Ovalle to Paloma section, and it has been finished.

The Calera to Cabildo line is open for traffic to Palos Quemados. A considerable portion of the Talca and Constitucion line, the total length of which is 92 kilometers, is open for traffic. The Coihue to Mulchen line, 42 kilometers, has been completed. The Temuco to Pitrufquen line is being rapidly pushed forward, and the Pichi Ropulli line has been opened for traffic. Finally, surveys have been completed for several other lines.

Science Notes.

M. Maurice de Thierry presented a memoir to the Paris Academy of Sciences regarding the estimation of atmospheric ozone on Mont Blanc. The experiments were made at Chamounix and the Grands Mulets, and the amounts found were two to four times greater than at the Observatory of Montsouris. The tests were made by noting the oxidizing action of an alkaline arsenite in the presence of potassium iodide.

The action of carbon monoxide and dioxide on aluminum has been recently described by MM. Guntz and Masson before the Paris Academy of Sciences, says The Engineer. At a high temperature, in the presence of a little iodide or chloride of aluminum, aluminum is readily burned in a current of either CO or CO_2. With the former the reaction is $6Al+3CO=Al_2O_3+C_3Al_4$, the aluminum carbide giving practically pure methane on boiling with water. Carbon dioxide gives the same product.

The relation between the flow of air and the pressure it exerts on surfaces exposed to its action is expressed by the formula $P = c\ v^2$, where P represents the pressure in pounds per square foot, v is the velocity in miles per hour, and c is a constant affected by temperature and barometric pressure, which is determined by experiment. The value attached to the constant c covers a wide range, but the United States Weather Bureau has adopted the value $c = 0{\cdot}0040$, making the formula $P = 0{\cdot}004\ v^2$. A generally accepted value is 0·005.

Recent experiments on argon by Messrs. Trowbridge and Richards show that argon, at low pressures, fluoresces (blue) under the action of the Hertzian waves. The spectrum given by the gas depends, says the Electrical Engineer, upon the voltage of the discharge through it. An oscillatory discharge will give the blue of high voltage spectrum; but if there is self-induction in the circuit, this is converted into the lower or red spectrum. It is suggested by the investigators that it might be possible to use an argon discharge tube as an inductometer.

In a paper on the preservatives of pharmacopœial preparations, by Mr. Martindale, read before the Pharmaceutical Society, it was stated that alcohol is not a germicide. When present to the extent of 20 per cent by volume of absolute alcohol, it has an inhibitory effect on the germination of most of the micro organisms occurring in aqueous solutions of vegetable and animal substances; but the germs propagate readily as soon as it evaporates. Salicylic acid is the preservative employed for the official solution of hydrochlorate of cocaine, which contains 1½ per mille of the acid, with 10 per cent of the cocaine salt. This solution, even if diluted with four times its volume of water, still keeps free from the fungoid growths to which cocaine solutions are so liable.

President David S. Jordan, of Leland Stanford Junior University, commissioner to investigate the condition of the fur seal, recommends, in his report to the Secretary of the Treasury, that the open season for the killing of females be abolished, to keep the Pribilof herd intact. He estimates the number of seals killed last summer as 440,000. About 27,000 pups died of starvation, and pelagic sealing caused the death of about 30,000. Since pelagic sealing began, more than 600,000 fur seals have been taken in the North Pacific and in Bering Sea, taking into account only those whose skins were brought to market. Many more were shot or speared, and lost. The number reported means the death of 400,000 females, the starving of 300,000 pups, and the destruction of 400,000 pups unborn.

It is said that 95 per cent of visual hallucinations in delirium tremens consist of snakes or worms, in one form or another, says the Electrical Review. Dr. Davis has been investigating the subject in the alcoholic wards of Bellevue Hospital with the opthalmoscope, and has brought out some interesting facts. In every one of the sixteen cases examined the blood vessels of the retina were found to be abnormal. Instead of being pale and almost invisible, as in their ordinary condition, they were dark—almost black—with congested blood. The blood vessels of the retina, which are so small and semitransparent in health that they are not projected into the field of vision, assume such a prominence that they are projected into the field of vision, and their movements seem like the twisting of snakes.

M. Henri Léon, in an essay on the saltness of sea water, gives in the Monthly Bulletin of the Biarritz Association the results of analyses of water from different seas, etc. Taking 1,000 grammes of water, the result showed in the Atlantic 32·657 grammes of saline matter, in the Mediterranean 43·735, in the Black Sea 17·663, in the Sea of Azov 118·795, and in the Caspian 62·942. Among the saline matter chloride of sodium varied considerably. The sea was found to be less salt near the poles than at the equator, and was more salt at a distance from land and where it was of great depth than near the land and shallow. The Mediterranean is the exception, which is explained by the comparatively few rivers that freshen its waters. Salt lakes are frequently more salt than the ocean, as, for instance, the Dead Sea, which is ten times salter than the Atlantic.