impervious the more they are to be avoided. India rubber stands at the bottom of the list, for it does not admit of the passage of any water; leather comes next; less objectionable, but still repellent, is close linen, as an instance of which we may mention the blue linen blouses worn by the Belgians and Dutch, and also the French, over their other garments as a kind of waterproof. Cotton has a great advantage over the foregoing, as it is, to a certain extent, porous; but the best of all percolators is a woolen material. Thus a flannel shirt is more healthy than a cotton one, and a blanket a far better covering for the night than a linen sheet.

The action of the skin depends also upon the circulation of the blood under its surface, and the latter is promoted by outward friction; a material which induces the latter is therefore also more healthy, and rougher underclothing, such as woolen or coarse cotton, are preferable to the enervating finer linen or silk.

Another point to be observed is the keeping of the skin warm, because warmth keeps the pores open, while cold contracts and closes them; and here again woolen clothing stands first.

Thus it is proved that in point of porousness, friction, and warmth, woolen clothing is to be preferred to all others.

But not only the material of the clothing is of importance, but also its cut. In warm climates, where clothing is more a luxury than a necessity, the loosest garments are the best; but in those latitudes where a certain amount of warmth has to be obtained by clothing the garments must be worn more closely fitting. We have before likened the human body to a steam jacketed pipe, where this steam is constantly in an ascendant motion; the faster this circulation takes place, the more is the skin cooled; it follows, therefore, that the most regular and constant evaporation is maintained by closely fitting garments, and the soldier's uniform is therefore the healthiest of all.

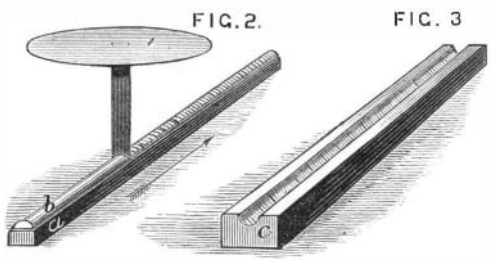
We need not here enlarge upon the very extended use of flannel underclothing, especially as shirts, which has come in vogue since cotton clothing rose to such exorbitant prices during the American war, and which, once appreciated, has not been abandoned since. This has also led to the production of a great many textile fabrics containing more or less wool mixed with cotton or other fibers, in order to counteract the shrinkage of the latter and make the fabrics more adapted for washing, one of the products being the vigogne yarn, to which we have lately drawn attention.—*Textile Manufacturer.*

A SIXPENNY PHONOGRAPH.

When a great scientific discovery or invention is announced to the world, such, for example, as the telephone of Professor Graham Bell, the microphone of Professor Hughes, or the phonograph of Mr. Edison, it is pretty certain in a short time to be followed first by spurious and unauthorized imitations, which, if the invention be protected, are nothing more or less than direct infringements of the patent, and after that by highly interesting modifications of the apparatus either for the extension of the principle, developing further physical facts, or to analyze those already discovered; or else for the reduction of the instrument to its simplest possible form, so as to place in the hands of the teacher as well as in those of the million a scientific toy which can illustrate and render familiar the principle which lies at the base of the more important and typical apparatus.

The sixpenny phonograph, which is represented in Fig. 1, consists, first, of a hollow cone of pasteboard, about one inch and a half in diameter, whose apex is connected to the center of a similar sized pasteboard disk by means of a lead wire about sixteen inches long; and, second, of a small board or tablet, on which is fixed one or a larger number of short lengths of lead wire, each of which bears upon its upper surface a phonographic embossed record corresponding to a certain word or sentence, by which it was originally produced. The method is as follows: The upper surface of a rectangular prism of glass, or other hard and rigid material, is thickly coated with stearine wax, which is then scraped into a convex form, as shown in the diagram, Fig. 2, in which *a* represents the glass bar and *b* the convex coating of stearine. This bar is then fixed into a simple phonographic instrument, which, by means of a screw or other mechanical contrivance, traverses it at a suitable speed below a diaphragm. This diaphragm is rigidly held around its circumference by an annular framework (not shown in the diagram), and is in every respect exactly similar to the diaphragm of an ordinary phonograph. To the center of this diaphragm is attached a thin flat plate, whose lower end is cut out to a concave curve to fit the convex surface of the stearine, *b*. When all is properly adjusted, and the temperature is so arranged as to give to the stearine surface the proper degree of hardness to insure the best results, the handle of the instrument is turned, and at the same time words are spoken against the diaphragm, which immediately set up in it vibrations, which are communicated to the plate or style. While this is moving up and down, following the vibrations of the diaphragm caused by the voice, the stearine coating of the bar, *a b*, is steadily drawn in the direction of the arrow below the vibrating bar, receiving from it a phonogram similar to that produced on the tinfoil of an ordinary phonograph.

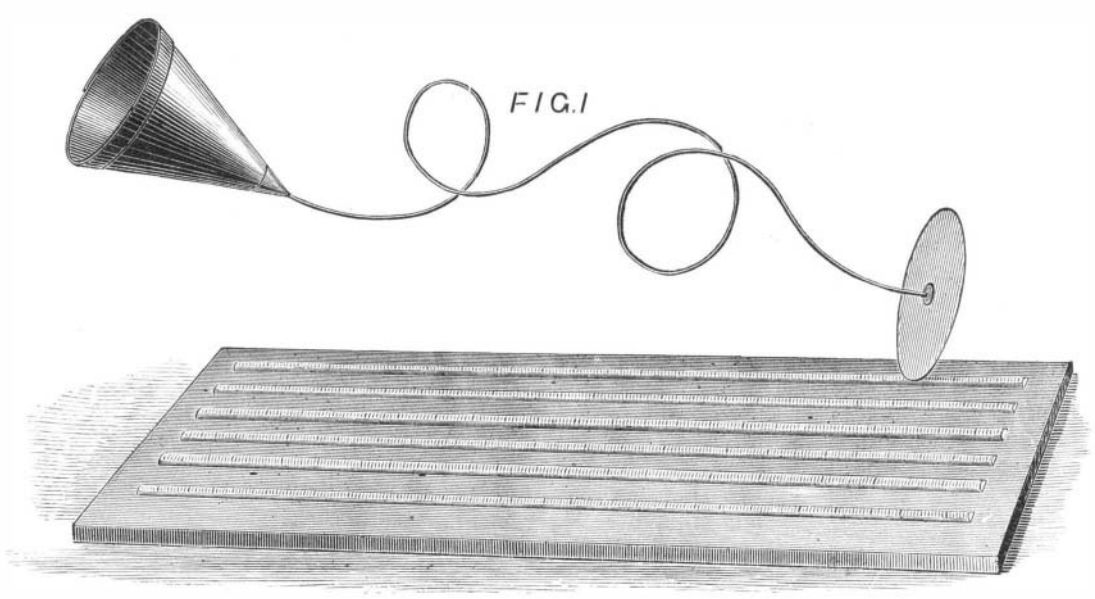
The stearine bar is then coated with a fine surface of plumbago, so as to give to it an electrically conducting surface, and it is then electro-plated with copper by the ordinary process. Out of the copper coating so formed the stearine is removed, and a rigid backing of lead or other metal having been run over the outside convex surface of the copper,



A SIXPENNY PHONOGRAPH.

a firm copper lined matrix or mould is formed, the whole presenting the appearance shown in Fig. 3, and consisting of a rectangular block having along the center of one of its sides a semi-cylindrical groove, *c*, of copper, which bears upon its surface certain raised striations corresponding to the depressions which were made by the diaphragm on the surface of the stearine. Into this groove is laid a piece of lead wire of about three or four millimeters in diameter, and the two being put into a press and squeezed together, the surface of the lead wire receives a permanent impression, which is an exact reproduction of the original impression made upon the stearine bar. From one copper matrix a very large number of lead impressions may be made, and we are told that the whole process can be gone through, and lead wires, each containing the record of a short sentence, can be made and sold with a profit for one halfpenny each.

We have had an opportunity of testing this simple little instrument, and the words come out of it with remarkable distinctness, though of course with but feeble power; and among the following words, all of which we have heard it utter, some were unmistakably clear: "Mon cher ami," "Louis Quatorze," "Victor Hugo," "La République," "Octavie," "Bonjour," "Lambrigot," "Misérable," and "Miracle," and it is a curious fact that while in the phonograph the words "Phonograph," and "How do you do?"



A SIXPENNY PHONOGRAPH.

come out with exceptional distinctness, so in this instrument the words "Bonjour," and the name of the inventor, "Lambrigot," are the clearest of those we have heard.

It is only fair to Mr. Edison, the inventor of the phonograph itself, to point out that the plan of producing a phonogram on a stearine surface, and afterwards reproducing it in copper by the process of electrolysis, was suggested by him long ago, but we do not understand that M. Lambrigot claims any novelty for that portion of the invention, but more especially for having produced a little instrument at the cost of a few pence, which can demonstrate the action of the phonograph and illustrate some of the most beautiful phenomena connected with the science of acoustics.

The sixpenny phonograph described as above in *Engineering*, is a novel affair, but we doubt if it is, after all, as simple and effective as one described and illustrated in our columns some eight months since. Page 118, Vol. 29.

Compressed Air for Blasting in Mines.

At a meeting held at Manchester, England, recently, Mr. Joseph Dickinson, H. M. Chief Inspector of Mines, in the chair, a paper "On the Advantages of Compressed Air at High Pressure (8,000 lb. and upward to the square inch) as compared with Blasting by means of Gunpowder or other Explosives," was read by Mr. W. E. Garforth, of Dukinfield. After referring to the various efforts which had been made to dispense with gunpowder for blasting in mines, Mr. Garforth stated that a machine had been invented by Messrs. Garforth, of Dukinfield, for bursting down coal by means of compressed air. The machine was portable, of small dimensions, so as to be suitable even for small mines, and could be worked by two men, and by it air had been compressed to 946 atmospheres, or 14,200 lb. per square inch. The compressed air was conveyed through wrought iron pipes to a cast iron cartridge 12 inches long, placed in a hole drilled in the coal, and the cartridge, when its known breaking strain was reached, burst and broke down the coal.

A machine had recently been made by Messrs. Garforth which was capable of giving 2,000 lb. pressure to the square inch, and by permission of Messrs. Morland, of Hollinwood, a trial was made at the Bower Colliery in the presence of some of the members of the Geological Society under the following conditions: The coal known as the Bower Mine was 5 feet thick and very hard. It was undercut to the depth of 4 feet 6 inches, and by a drilling machine a hole was cut 39½ inches in depth and 7 feet from the cut end of the coal. The cartridge, 11¾ inches long, 3 3-16 inch diameter, and 9-16 inch thick, was put into this hole and stemmed tight. The pipes and machine were then attached, and at 9,553 lb. pressure per square inch, the coal was broken down, the quantity being estimated at between 5 and 6 tons.

After describing the great difficulties which had been experienced in perfecting the machine and the cartridges, Mr. Garforth proceeded to lay before the members his ideas of how this great power, obtained by means of compressed air, could be utilized. He would first state that among other points which had been proved by the experiments which had been made were: (*a*) that 14,200 lb. pressure per square inch could be obtained; (*b*) that a pressure of 9,550 lb. per square inch was sufficient to break down the coal in a hard mine like that of Bower Colliery; and (*c*) that the pressure when obtained could be kept for hours both in the machine, pipes, and cartridges. In the suggestions which he was about to make he felt convinced that a machine to meet the requirements of deep mining should be such as not to require too much manual labor, owing to the high temperature experienced in deep and extensive workings.

What he proposed was to use a vessel or small receiver, made so very strong that the bursting point would be six or seven times the required pressure, proved beyond doubt to be perfectly safe in transit, also of such a capacity as would allow highly compressed air to expand into the pipes and cartridges without reducing the pressure below the known bursting point of the cartridge. The air compressing machine necessary to fill this receiver with highly compressed air might be fixed on the surface, or, if preferred, at the bottom of the shaft, and worked by steam in the ordinary way. These portable receivers should then be charged with air to the required pressure, sent into the various working places, attached by means of a valve and pipes to the cartridges with the coal, and then by simply opening the valve the air in the receiver would rush into the cartridge and explode it, the operations requiring little or no manual labor. Of course, it would be understood that the receiver could be placed at a sufficient distance away to obviate the use of pipes; the receiver could be placed near, and the valve opened by other means.

If the expansion of the air were found to be such as to make the receiver too large, a small hydraulic pump might be connected to it, and by forcing water through the valve opening upward, the water would thus occupy the place of the air, and by this means any pressure which had been lost through expansion could be recovered, or, if necessary, increased to more than the original pressure. As water was, comparatively speaking, incompressible, the time taken to effect this operation would not be long nor the labor very great. In the same way that machines were improved upon the original idea, so he felt convinced that in a short time this great force of ten, fifteen, or twenty thousand pounds pressure per square inch would be so utilized that they would be able to put into the hands of the miner a power that, when gunpowder and other explosives were prohibited, would enable him to get the coal with the same facilities as now, without the risks from blown out shots, explosions, or the production of deleterious gases.

It might appear strange to old miners when it was proposed to place a small machine in the hands of the workmen, but

certainly not more strange than it did to engineers when men chipped and worked by hand what was now done by planing, riveting, or other machines. When they considered the great restrictions at present placed upon the use of gunpowder and other explosives in mines, and that every day the coal to be got lay at a greater depth, and the difficulties of getting increased more than *pro rata* with the depth, he thought there could be little doubt that in a few years the government would entirely prohibit the use of explosives in mines. He now proposed to compare the two systems of breaking down coal —by gunpowder and that by compressed air at 8,000 lb. pressure per square inch or upward. The undermining of the coal would in both cases be about the same, also the time taken to drill the hole, provided the machine drill was used. If the arrangement of the receiver as proposed in the foregoing remarks, with or without hydraulic pump, were carried out, then the time taken to fire the gunpowder or burst the cartridge by compressed air would be about the same. In stemming the hole there would be a gain in favor of gunpowder of about ten minutes, but at the same time it would be at greater risk. If instead of the portable receiver a machine had to compress the air to the required pressure, there would be a gain of about thirty minutes in favor of gunpowder; but, as they were aware, when a shot had been exploded by gunpowder the working place was filled with smoke for a quarter, half, and in some cases three quarters of an hour, so that the gain in time was more than counterbalanced.

Compressed air, however, possessed advantages ever gunpowder which could not be too highly estimated, above all as regarded safety. He thought there was no one connected with mining but would admit that the time had now arrived when some power ought to be found to supply the place of gunpowder when it was prohibited, to enable us to produce coal as economically then as now. Should gunpowder and other explosives be prohibited, what was the best means to supply their place? He thought for the reasons he had named in the foregoing paper that compressed air would stand foremost, especially for its safety. Although monetary considerations might, to a certain extent, weigh with people, no one could deny for a moment, after seeing the lavish expenditure made by colliery proprietors for the safety of their men, that safety was the main consideration with both mine owners and the managers.—*Colliery Guardian.*

THE NEW YORK ACADEMY OF SCIENCES.

A meeting of the New York Academy of Sciences was held Monday evening, May 12, Prof. Newberry in the chair.

COPPER AND SILVER IN MAINE.

At the request of the president, Dr. Hamlin, the author of a very interesting book on tourmalines, gave an account of the new mineralogical discoveries in Maine. Until very recently it was not known that either copper or silver existed in Maine. A copper belt, some two miles long and from 200 to 400 feet wide, has now been discovered about the middle of the southern part of Maine, directly on the coast; but it is impossible as yet to present any trustworthy information in regard to the richness of the deposit.

Some twenty miles to the northeast of this copper belt silver has been found in flakes, masses, and filaments, specimens of which have found their way to Boston for exhibition. A shaft has been sunk some hundred feet deep, and it is reported that the ore increases in richness with the depth.

GEOLOGICAL NOTES.

Dr. Newberry announced the receipt of a collection of fossils from Moosehead Lake, and also of one from Fort Bennet, Dakota, which latter appeared to the finders as of vegetable origin, resembling a species of nuts, but which on examination proved to consist of saurians' teeth, having some resemblance to the teeth of crocodiles, but not being as yet sufficiently investigated for identification.

Further geological investigation of the north shore of Long Island confirms the conclusion previously arrived at, that the micaceous sandstone found there in the glacial drift, and containing impressions of dicotyledonous leaves, belongs to the cretaceous period. Its source has not as yet been ascertained.

The paper of the evening was by Dr. Albert R. Leeds, of the Stevens Institute of Technology, on the presence of peroxide of hydrogen in the atmosphere.

PEROXIDE OF HYDROGEN IN THE ATMOSPHERE.

The existence of hydrogen peroxide in the atmosphere has been doubted by many investigators. The reason of this is to be found in the difficulty of ascertaining its presence, seeing that several other substances, such as ozone, nitrous acid, and nitric acid, give almost identical reactions. Numerous tests have been devised to distinguish these substances, but nearly all are liable to objections. A solution of iodide of potassium and starch is colored blue by ozone as well as by the peroxide. The addition of sulphate of iron, or of litmus, has been recommended, but the results have been questioned. Struve proposed a solution of oxide of lead in caustic potash, with the addition of a few drops of basic acetate of lead, in which the peroxide of hydrogen produces a precipitate of binoxide of lead. A freshly prepared solution of guaiacum that has not been exposed to the light, and to which a watery infusion of malt has been added, first turns pink and then blue by the action of the peroxide, and forms a test of such delicacy that one part in ten millions can easily be detected. Yet this test is also affected by ozone. The investigations in progress at the Institute seem to indicate, however, that ozone acts upon it much more slowly than peroxide of hydrogen does. The same remarks apply to the test of A. Levy, of Paris, who uses arsenious acid and arsenite of sodium, which are converted into arsenic acid and sodium arsenate by the action of ozone.

Reasoning from the analogy of the recomposition of nitrate of ammonia from nitrous oxide and water, our distinguished chemist, Sterry Hunt, threw out the ingenious suggestion that the nitrates in the atmosphere might be due to the combination of atmospheric nitrogen with evaporating water. Later, Schönbein, the discoverer of ozone, came to the same conclusion from different premises, and actually found nitrites in the air wherever water was evaporated. Bohlig, however, demonstrated that in these experiments the proper precautions had been neglected, and that the nitrites found pre-existed in every case in the atmosphere. When the air was previously purified from every trace of nitrites none could be detected in the results of the experiments. This was a fortunate fact, for if nitrites were formed by mere evaporation of water in the air, atmospheric tests would be of no value, as we could never determine to what agency our reactions were due. In another sense, however, it was unfortunate, as it deprived us of a very plausible explanation of nitrifaction in the atmosphere, on which plant life is in a great measure dependent.

The most extensive investigations of the presence of hydrogen peroxide are those of Schoene, of Moscow, who examined all the snow, hail, rain, and sleet that fell in Moscow for one year, beginning July 1, 1874, and ending June 30, 1875. He found peroxide present in 208 out of 215 specimens of hail and rain, and in 86 out of 172 specimens of snow and sleet. The average amount was 0·17 c.c. in 1,000 cubic meters of air. His method was to add his sample to a weak solution of iodide of potassium and starch, and to compare the color ation with that produced by standard peroxide solutions of different strength. He found among other interesting results that the equatorial winds were much richer in peroxide of hydrogen than the polar winds. Houzeau, of Paris, was unable to find any peroxide in the atmosphere of that city, and it is suggested that it may be absent in some localities. Prof. Leeds found none in Hoboken, although his processes are so delicate as to enable him to detect minute quantities like the following: 100,000,000 parts of air were found in one analysis to contain 16 parts of ammonia, 10 parts of nitrous acid, and 17 parts of nitric acid, equivalent to 15 parts of nitrite and 20 of nitrate of ammonia.

The influence of these substances may be of the utmost importance in relation to health and disease, as well as to vegetable life and growth. But the investigations made in reference to their determination, both qualitative and quantitative, will be of limited utility so long as any doubt is possible as to the reliability of the tests employed. When the New Jersey Board of Health desired Dr. Leeds to furnish them with trustworthy ozonometers to be used in systematic observations throughout the State, he was obliged to reply that there were none he could recommend.

INDUCED MAGNETISM.

Mr. Wolcott then exhibited an experiment to show that a wire, magnetized at its middle point by contact with the pole of a magnet, had the same polarity at both ends. Prof. Seeley then made some remarks on induced magnetism, which were discussed by Mr. Warner, and the Academy adjourned.

C. F. K.

Hyposulphite as a Therapeutic Agent.

Anthony's Bulletin contains a communication from a correspondent proclaiming the rare virtues of hyposulphite of soda as cure for erysipelas. Medical men are familiar with the use of hyposulphite as a somewhat active aperient, and it is regarded by some as very valuable in removing impurities of the blood; but it has not come much into use in medicine. We place the new claim for it on record, but would caution our readers against experimenting with disease. Erysipelas is too dangerous a malady to be tampered with, and should be placed under the treatment of a competent medical man. We subjoin the communication in question:

"I take pleasure in communicating the needed information concerning the virtues of hyposulphite of soda in erysipelas. Of course, when erysipelas proceeds from a wound, it is more delicate to manage, and requires the best surgical skill; but when it is of the milder form, on the outside skin in the face or any other part of the body, proceed as follows: Take of hyposulphite of soda any quantity, and make a saturated solution in a bottle of any convenient size—six, eight, or ten ounces. If the individual is a strong, hearty man, and the disease has a good start, give your patient one tablespoonful every hour for twelve hours; then decrease the dose, as the benefits become manifest, say once in three hours. It may cause diarrhea; but never mind, it will destroy any febrile symptoms. Twenty-four hours is generally sufficient to produce a decided change for the better, unless it has six or seven days' start, in which case it will take longer. The results are generally so wonderful that I have never known the remedy to fail. With an old person you may substitute a teaspoonful for tablespoonful, and once every two hours. You may put this down: that the sooner you can get a good quality of the soda solution into the body, the sooner the trouble will be over. Now, for an outward application: use equal parts of the soda solution and glycerine; saturate cotton flannel with the above, and lay on the part affected. Eat simple food—avoid all exciting food and drink; farinaceous diet is absolutely necessary. If you can bathe the part affected with the above solution, do so; then lay on the saturated cotton.

"Hypo is equally as efficacious in any poisons from insects or vegetables; old wounds in sores are soon healed by washing the parts in a solution of soda. It is also good in typhoid fever, carefully administered.

"Now, if a person has a form of erysipelas that is not so decided, but (say) chronic, let him take a teaspoonful every night of the solution, and the disease will be entirely removed, if kept up for a month. The disease seldom or never attacks a person the second time when eradicated by the soda treatment.

"If any other information is needed, I shall be very much pleased to communicate, for I consider the foregoing has saved my life, and it has cured fifty persons in succession without fail right under my own supervision."

RECENT MECHANICAL INVENTIONS.

An improved apparatus for automatically measuring and discharging grain has been patented by Mr. Robert H. Edmiston, of Loveland, Col. It is particularly intended for use in connection with thrashing machines to measure the grain as it is delivered from the thrasher.

Mr. Daniel D. McIntyre, of Sterling, Neb., has invented an improved washing machine, consisting of a semi-cylindrical suds box, having a slotted bottom, and having a pump barrel for creating a circulation of the suds, as the semi-cylindrical rubber is operated by means of a hand lever.

An improved press for compressing cotton and other similar materials has been patented by Mr. W. J. Butts, of Willow Green, N. C. It consists in a horizontal box mounted on wheels, and drawn forward by a screw, the ribbed bed at the end of the box being drawn forward by a screw toward a fixed ribbed platen, so as to compress cotton contained in the box.

Messrs. F. E. Cross and R. G. Speirs, of Waterbury, Conn., have patented an improved machine for straightening and cutting wire. It is arranged to work automatically, and it consists in an arrangement of clamps and a stopping device in connection with cutting mechanism, which cannot be described without an engraving.

An improved grain toller has been patented by Mr. David Waugh, of Willsburg, W. Va. It consists in a notched rotating disk arranged in the grain tube. It is contrived so that the grain that passes through the notch as the disk revolves is counted as toll.

An improvement in machines for dressing millstones has been patented by Mr. David L. Ellis, of Homer City, Pa. It consists in the combination of an adjustable slide provided with a rubber block or strip and set screw, and a peculiar arrangement of frame and feed screw.

Messrs. S. S. Black, of Fredericton, N. B., and Charles A. Black, of Chicago, Ill., have invented an improved machine for trimming the sole edges of boots and shoes. It consists in a combination of ingenious devices, whereby the sole is quickly and neatly trimmed.

Large Farming a Precarious Business.

The following figures are given by a San Francisco correspondent of a Philadelphia paper, as evidence that farming on a gigantic scale is profitable neither to the country nor to the farmer. He says: "The largest wheat producer in California, or in the world, is Dr. H. J. Glenn. He was formerly from Monroe County, Missouri. He is a man of great enterprise and energy. His ranche lies in Colusa county, and comprises 60,000 acres, nearly all arable land. He has this year 45,000 acres in wheat, which, at a low calculation, will produce 900,000 bushels. His wheat will sell for 85 cents per bushel, or $765,000. Dr. Glenn has been farming ten years, and one would suppose he ought to have a handsome sum to his credit in bank; but what with a failure of crops—which occurs two years in every five—and the enormous interest he pays on his loans, he is said to owe a round million of dollars. Last year his credit was bad, as he had no crop. Now, with his splendid crop in prospect he will probably get out. The Dalrimples of St. Paul, who, ten years ago, were the largest farmers of wheat in Minnesota, raising as much as 40,000 bushels in a single year, went to the wall. Another large wheat raiser is D. M. Reavis, whose land lies on the borders of Colusa and Butte counties. He is also from Monroe county, Missouri, and has an unpretending little estate of 15,000 acres, 13,000 of which are in wheat, which he thinks will average this year 30 bushels, or 390,000 bushels. He also is hard pressed, and I am told is paying 9 per cent on a couple of hundred thousand dollars of borrowed money. If farmers raising half a million to a million bushels of wheat cannot get out of debt, it might be well to inquire what is the use of having so much land? The truth is that from the frequent failure of crops in California and the waste that attends on large operations of that kind, farming on a gigantic scale in this portion of the Pacific coast must be considered a failure. North of this, in Oregon and Washington Territories, there is no failure of the harvest; farming operations are carried on on a smaller scale, and consequently the farmers, while not rolling in wealth, are all well to do."

Rapid Communication.

A merchant, sitting in his office in South St., New York, recently received an answer to his dispatch sent to Shanghai, six hours previously. Thirty thousand miles in six hours is good time, even for the telegraph. The charge to Shanghai is $2.80 per word; to Yokohama, $3.05; but the code, or cipher, is so well systematized by certain mercantile houses, that a single word serves for a dozen when transcribed.