made at the expense of matter. The combustion of the fuel under the steam boiler is only a transfer of the force which had been employed in the formation of the wood and coal; and it is so with every other motor that can be used. The ball propelled from the cannon had its force-equivalent transferred from the labor of the manufacturer of the powder. Not only the powder but the ball as well, in its rounded or elongated shape, had to contribute its part in the play of projection. This system of compensation, as manifested in the correlation of forces, holds its equivalents to as strict a measure of relation as the fulcrum of the scale beam does the things that are weighed in the balance. The seven or eight per cent of the units of heat, which are all that are at present utilized in the transfer of motion from the fire under the boiler to the machinery in the mill, so far from invalidating the science of mechanical forces as correlated, only goes to prove that we are far behind the constructive perfection which ought to give us much more, and which ought to stimulate the inventive genius of all mechanical engineers. The conduction and conveyance of power, that is the transfer of it from the fuel to the propelling wheel, is much, in the condition as to economy, as that of carrying water in a sieve. There is too much lost on the way side. The bushel of oats put in the horse's combustion chamber does a great deal more work than the bushel of oats (with its steam included) will do when burned under the steam boiler; and yet the force-equivalent in both cases must be the same.

The economizing of motion is a good deal like going a fishing. He that understands the nature and the habits of the fish that he goes for will be likely to succeed the best. So in the mechanical profession: he that understands the law of motion and mechanical forces will be most likely to get the most work out of a certain expenditure of motion-transferring appliances. There is yet a broad domain and a wide track for the exercise of mechanical and engineering skill; and the man who adds a single increment of improvement in the economy of the transfer of motion becomes a benefactor to the human family.

The *inertia* of the old doctors has given way to the *vis viva* of modern scientists. The old *inertia* was defined to do and not to do: not a very comprehensive definition. The ball, when it stops rolling on the philosopher's board, goes only to show that it has played out the motion that was transferred to it by the motor, whatever that motor may have been.

There can be no such thing as increasing the amount of force in a given quantity of matter; but there is such a thing as economizing that power, that is to say, enabling it to do more work through one instrumentality than through another; and the perpetual motion makers ought to take it to themselves that they will not succeed in the solution of their problem by simply adding wheels and levers, unless they hope to move them by the psychic force; a force whose existence can be called into action somewhat in the way that the sailor whistles up a wind. Mr. Crookes is of the opinion that a force, without the intervention of cognizable matter, does exist and that it can be called into action. Mr. Dauskin, an estimable gentleman and spiritualist of Baltimore, told the writer of this article that he had witnessed such phenomena with his own eyes; but Mr. Coleman Sellers. President of the Franklin Institute, gave an illustrated lecture, at the Philadelphia Central High School the other evening, on "the Science of Delusion," in which he demonstrated that it is not altogether safe to trust implicitly to our eyes.

Motion, like matter, is constant and universal. It cannot be annihilated, nor can it be increased or diminished; but it is transferable, and the best we can do is to devise means through which this transfer can be accomplished by the least cost of labor and material.

Philadelphia, Pa. JOHN WISE.

### London International Exhibition.

*To the Editor of the Scientific American:*

It may be of considerable interest to many of your numerous readers to be informed that articles for the London International Exhibition of 1872, which opens May 1st, must be delivered at the buildings at South Kensington, London, if belonging to the class including "Machinery and Raw Material," on the first day of March, and, if included in the class comprising "Recent Scientific Inventions and Discoveries" on Saturday, March 2. Other classes have other specified days for the delivery of the articles for exhibition, but the list would be too long to trouble you with in this letter. The above information is officially promulgated by Major General Scott, Secretary of Her Majesty's Commissioners.

HAMILTON E. TOWLE.

COLORED CANDLE LIGHT.—Wax candles are made of different colors, but they all emit a white light. Why may not candles be manufactured, by introducing certain chemicals into the material from which they are made, so as to show a variety of colors, such as blue, red, green, etc.? By arranging such candles in tasteful groups, beautiful effects may be produced in illuminating buildings. If some ingenious chemist will devise a way of embracing a cheap chemical with any of the material used for illuminating candles so as to render the light emitted from them of any desired color, he will make a fortune by his discovery.—*Commercial Bulletin.*

[This is what we told our chemists several years ago, and still no advance has been made in this direction. If chemicals could be introduced into any safe illuminating material so as to produce a variety of colors, the discoverer would reap a rich harvest for his invention.—ED.]

[Correspondence of the Scientific American.]

## JAPAN.

**Interesting Letter from Professor Griffis--Establishment of a Scientific School at Fukuwi--General View of the Japanese Status--Rapid Progress of the Japanese in European Knowledge and Arts --Mineral and Agricultural Resources of Japan.**

FUKUWI, Province of Echezen, Japan, Nov. 25, 1871.

One of the constant readers of the SCIENTIFIC AMERICAN, responding to the invitation extended by you to the American citizens to keep you informed of the progress they are making, would send greetings to you from this end of the earth, and would hope to point out a few signs of progress among the people now beginning their "second life in the history of nations."

The writer, who had been an instructor in chemistry in America, and had among his pupils thirteen of the Japanese students, received an invitation from the Prince of the Province of Echezen, to come to Japan, organize a scientific school, and give instructions in the physical sciences. It seemed rather a discouraging place to go to (nearly the antipodes of New York); but, being earnestly urged by the young men from Japan, the writer came to Fukuwi, arriving here March 4th. To a pioneer in the interior of Japan (foreigners not being allowed to penetrate more than twenty-five miles from the treaty ports) it seemed at first like beginning in the stone age. However, we found that several of the young men had been diligently studying medicine and chemistry through the Dutch language, which has been for centuries the language of high culture in Japan. As fruits of this, I found that vaccination was practiced, dissection slily carried on, a powder manufactory with a nationalreputationestablished, also a gun factory in which very fair specimens of smooth bores and rifles were made and finished, and even a creditable attempt made to construct a breakwater at Mikuni, the sea port of this city.

In visiting the mines, we found that blasting was known, but not yet fully applied. Pumping was not in vogue, though it has been estimated that fully one third of the profitable mines of Japan have been abandoned by reason of the invading water. The Japanese are very quick to apply machinery, however, and in several provinces we know of pumping machines, driven by steam, being applied. In several of the provinces, foreign engineers are engaged on contracts of three years, and are revolutionizing the old methods of mining. There seems to be abundance of copper, mercury, zinc, tin, and iron, the latter being mainly in the form of magnetic iron ore.

Manufactures are not backward. The Japanese, while welcoming the foreigner and eager to get his knowledge, his inventions and productions, are yet anxious to be independent and to "do it themselves." They not only run their own steamers, and drive their own factories, but each mechanic seems desirous of trying his skill at something foreign, when said foreign thing is undoubtedly worth making. Hence, glass blowing, drug manufacture, wood carving, leather working, furniture, silk winding machinery, etc., etc., though in their infantile stages, are yet striding on towards perfection.

In fitting upour own laboratory, many pieces of apparatus and peculiarities of building, etc., requiring great patience and considerable mechanical skill, were furnished by workmen who were eager to learn; and, considering their rude tools and appliances, they succeeded remarkably well.

It must be remembered that the normal Japanese house, not excepting those of the Daimios and rich men, are excessively plain, walls and neatly matted floor under a roof being the main necessities; no furniture, no chairs, nothing suggests the luxurious civilization of Europe or America. In the city in which we dwell, the only chimneys are those upon the chemical laboratory, and our own dwelling house—a house, by the way, built by a Japanese carpenter under our directions, and exceedingly American and complete in every respect.

We do not propose to speak of the railroads now building, or of those projected, or of the telegraphs and steamships owned and worked by the Japanese. These evidences of advancing civilization are most visible at the sea ports, and will be duly chronicled. We speak only of the pulsings of the new civilizations in the interior, two hundred miles from any foreigners. We may say in passing, however, that we have seen the "report" or "Blue Book of the Department of Civilization" of the Imperial Government, and find in their schedules full preparations made for light houses, railroads, telegraphs, a postal system, introduction of machinery, cattle breeding, scientific farming, navy yards, coast and inland survey, road making, and numerous other enterprises. Of course, it will require years even to fully organize these plans; but when it is remembered that all this apparatus of civilization has been suddenly grafted on a nation hitherto hermetically sealed to the world, the marvel will be that such gigantic enterprises can be entertained. The Japanese, while liberally engaging professors, engineers and agents, are yet determined not to let Japan become as India, nor be passive recipients. They have now at least three hundred picked young men studying in America and Europe, and on their return they will personally engage in the business of superintending the great public works of the country.

The timber of Japan is marvellously rich and abundant, and is mainly grown on the mountains. Indeed this is the land of "the everlasting hills," and the practically waste land is in very great proportion to the cultivated soil. The latter, however, is very fertile, and the whole country is cultivated like a garden. The tools are pretty much the same as those used ten centuries ago. The plows are simply sticks pointed with iron. The rice is cut by hand with a small hook, and threshed by drawing it through iron teeth. They get very good crops on their irrigated lands; but much reclaimable soil exists neglected, and scientific farming is entirely unknown as yet, except in one or two provinces in which American farming machinery has been introduced. Cattle breeding claims much attention, and we can assure your readers that the superstitious fanaticism concerning beef and pork is rapidly vanishing.

In many provinces beef is eaten, and in the large cities it is sold at the corners of the streets as a delicacy, and devoured with gusto by gray heads and urchins. Whenever our cook slaughters a cow, he has no trouble to sell the meat; and five magnificent specimens of California cattle, recently brought here, promise to leave offspring more promising than the stunted native cattle. Several sharp Japs, who read the signs of the times, have herds of swine, and our local government is very desirous of having works on cattle rearing and breeding translated, and have imported the cattle spoken of.

We are trespassing on your crowded columns, and will, therefore, hasten to a close. We forgot to mention the coal which is found here near Fukuwi; it is not very abundant, nor of first class, though extended exploration might reveal formations of a better quality. However, were you to come to our house, Mr. Editor, and see our sparkling grate heaped with the black diamonds of Japan, you would think civilization had really begun.

As Rome was not built in a day, nor our country settled in an hour, we must have patience to await fully the flowering of this nation. Patient toil and faith are needed, but even in the everyday prose of the pedagogue we feel something of the glow of poetry, while reading the faces of our Japanese scholars. We have nearly 125 promising pupils in chemistry and physics, and with two good interpreters, apparatus from America, a printing press up, and earnest young men to help in translating and applying the knowledge gained in school, we hope to make the "Fukuwi Scientific School" one of the centers whence shall radiate the new civilization. In conclusion, I cheerfully acknowledge the great help in practical hints, etc., from your valuable paper, which we are glad to tell our pupils is the SCIENTIFIC AMERICAN. WILLIAM E. GRIFFIS,

Professor of Chemistry, Fukuwi, Japan.

[Reported for the Scientific American.]

## MEETING OF THE SOCIETY OF ARTS OF THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

HELD IN THE INSTITUTE IN BOSTON, JANUARY 11, 1872, THE PRESIDENT, J D. RUNKLE, IN THE CHAIR.

AUTOMATIC REGISTERS.

Dr. Sternberg, U. S. A., exhibited and described a new application of electromagnetism. He uses this subtile agent for the automatic regulation of temperature. His apparatus is applicable wherever artificial heat is employed, as in the warming of buildings, and also in various processes in the laboratory and the arts.

To watch a thermometer and operate a damper or register by following its indications, is, to say the least, unscientific, besides requiring more time and attention than can ordinarily be given. The attempt has frequently been made to effect the automatic regulation of temperature by using the expansion of a metallic bar or of a volume of confined air to operate a damper; but satisfactory results have never been obtained by these methods, and their application is limited, as the regulator must be placed near the furnace, and the expansion of a metallic bar for a variation of a few degrees of temperature is so slight that it would be impracticable to use a bar long enough to regulate the temperature to a nice point. The use of confined air for this purpose is still more unsatisfactory, as the air is affected by barometric changes. And though such an apparatus might regulate the temperature of the hot air chamber of the furnace with sufficient exactness, it could not control the temperature of distant apartments, which is far more important.

Dr. Sternberg's invention is intended to obviate these difficulties, and is at once simple and efficient.

The battery wires are so adjusted in connection with a thermometer that when the temperature reaches the desired point, the mercury in the thermometer establishes a circuit, by which the register or damper is shut; upon the slightest reduction of the temperature, the mercury falls, the circuit is broken and the register or damper opened.

It is obvious that the thermometer may be placed at any distance from the furnace, and may regulate the temperature of an apartment by controlling either the register or the damper of the furnace.

If the wires from the thermometer be made to operate a damper which controls the supply of air to the furnace, fuel will be saved.

Automatic ventilation may be secured by the same apparatus—electricity controlled by a thermometer.

Where a number of rooms are warmed by one furnace, he would let the thermometer in the room most used control the damper of the furnace; and the temperature of other rooms would be regulated by automatic registers controlling the flow of heated air to them.

The mechanism for operating the registers and dampers is simple and requires but little power; one battery cup being sufficient to perform any of the operations.

The point of contact between the wire and the mercury is easily adjusted to any required temperature, and a change of a fraction of a degree will make or break the circuit and cause the apparatus to act.

ELECTRIC CLOCKS.

Mr. James Hamblett addressed the Society upon the sub-

© 1872 SCIENTIFIC AMERICAN, INC.