Advice to Inventors—Theory and Practice.

The following remarks are extracted from a lecture of Prof. Rankine, F.R.S., and published in a recent number of the London *Mechanics' Magazine*; they deserve the attention of every inventor and mechanic:—

"Early in the eighteenth century, Newcomen combined the inventions of his predecessors into the atmospheric engine; in which, for about half a century, improvements in detail continued to be made by Potter, Beighton, and others, until, in the hands of Smeaton, it became (considering the general condition of practical mechanics at the time) a very perfect machine in workmanship and mechanism. But all this improvement had been merely *empirical*; and in everything that depended on principle, the steam engine of that period was a most rude, wasteful, and inefficient machine. Then came the time when science was to effect more in a few years than mere empirical progress had done in nineteen centuries. Watt set to work scientifically from the first. He studied the laws of the pressure of elastic fluids, and of the evaporating action of heat, so far as they were known in his time; he ascertained as accurately as he could, with the means of experimenting at his disposal, the expenditure of fuel in evaporating a given quantity of water, and the relations between the temperature, pressure, and volume of the steam. Then reasoning from the data which he had thus obtained, he framed a body of principles expressing the conditions of the efficient and economic working of the steam engine; and the first engine that was made according to those principles, completely succeeded, and fulfilled his anticipations exactly.

His success was owing to this—that before proceeding to put his invention in practice, he had well studied its theory.

It is true that the empirical practice of all arts is more ancient than the theory; and this indeed is necessary, because practice furnishes part of the data on which theory is founded, and propounds questions for theory to solve.

But those who study practice empirically alone, have for their guidance only the structures and machines of former engineers, with the waste of material and loss of power, and other faults involved in them; and, with all the patience and ingenuity which can be applied to those data, considerable improvements can only be attained at the cost of repeated failures, and errors in principle may remain forever undetected; but he who studies the sciences that bear upon his art, has before him, in natural objects, and in the order of the universe, structures in which there is no waste of material, and machines in which there is no loss of power. Thence he learns to see in each work of human art how far it falls short of perfect efficiency; and although perfect efficiency be unattainable, he learns to judge in what direction practice ought to strive in order to approximate to perfect efficiency as near as is possible for human skill.

The theory of *machines* is founded on the principles of *dynamics*, or the science of the relations between motion and force.

Pure mechanism is the name which has been given to the *cinematical* part of the theory of machines, or that which takes into consideration their action, transmitting and modifying motion only, without regard to the force which is at the same time transmitted, such as the parallel motion, the arrangement and proportioning of wheels, and the correct shaping of their teeth.

The *dynamical* part of the theory of machines considers them as transmitting at once, both motion and force, or performing *work*. It treats of the resistance, whether from solids or fluids, which impede the action of machines, the means of regulating that action, and the nature of the sources of motive power, whether animal strength, the gravitation of water, the currents of the air, or the mechanical action of heat. The entire theory of the work of machines is founded on one principle, that of the *conservation of energy*.

Glycerine and its Uses.

A lecture on the above subject was recently delivered before the "Franklin Society," of Providence, R. I., by J. P. Balch. We extract and condense a few sentences taken from the report of it in the *Manufacturers' Journal*, of that city:—

"Glycerine is the base which unites with the fatty acids to form those three remarkable substances—stearine, margarin, and olein, of which substances, combined in various proportions, the fats and fixed oils are composed. This composition of fats was discovered by Chevreul, in the course of long researches, during the first quarter of this century; and in 1853, Berthelot, of Paris, proved synthetically what Chevreul had shown by analysis: combining glycerine with the fatty acids into stearin, margarin, and olein. In the colossal candle manufactory of Price & Co., London, steam, at a temperature of 550 to 600°, is blown through fatty matter in a distillatory apparatus; the fatty acids are separated from the glycerine, and the two distil over separately. Glycerine thus obtained is free from the metallic and other impurities left by the common process of separating it from fats. The applications of glycerine depend mostly on its remarkable solvent powers, its property of absorbing moisture, its bland and soothing character as an application to injured and diseased surfaces, and its nutrient qualities. As a fattener it is likely to be a useful adjunct to cod liver oil. It has also considerable power of preserving animal substances from decay, and fixing their colors, and has been proposed as a means of preserving in their beauty the brilliantly colored fish of tropical seas."

Arrangement of the Crystals of Cast Iron.

Robert Mallet, an Englishman, the author of a work published in London, on Artillery, he affirms that in the "molecular aggregation of crystaline solids, the crystals always arrange and group themselves with their principal axes in lines perpendicular to the cooling or heating surfaces of the solid; that is, in the lines of direction of the heat wave." He assumes, that as a gun, in cooling, radiates beat from the center, outward in all directions, the particles arrange themselves in radial lines ready to be separated on the application of a comparatively slight force, thus possessing least strength in the direction where it is most wanted. He illustrates by the following experiment, which might be readily tried:—"If a cylinder of lead, some four or five inches long, and of about the same diameter, be cast around a cylindrical bar of iron about an inch and a half in diameter, and considerably longer, the lead becoming rapidly consolidated by the contact of cold material interiorly as well as exteriorly, will have a tolerably homogeneous structure, and may be cut into, beaten out, &c., without exhibiting any trace of crystalization. But if one of the ends of the central bar be heated red-hot, and time be allowed for the heat to be conducted along into the interior of the lead, and thence conducted outward in all directions till the heat is nearly up to the melting point of lead—say to about 550° Fah.—and the lead be now sharply struck with a hammer, the whole mass will be found to have a crystaline structure, all the principal axes of the long thin crystals radiating regularly from the center; and by a few blows of the hammer the mass will separate and fall to pieces, so complete are the planes of separation."

As a consequence of this law, it is inferred that every abrupt change in the form of the exterior of any casting, is attended by an equally sudden change in the arrangement of the crystals, accompanied with one or more planes of weakness in the mass. The small cast-iron cylinder of the hydraulic press used in raising the tubes of the Britannia Bridge, failed under the immense pressure, until another form was substituted with a bottom more rounded; and the theory laid down, and to a certain extent established by this writer, would seem to indicate that when angular forms are absolutely required in castings exposed to great strains, it might be expedient to cast the parts in rounded forms, and then turn or plane them to the forms required.

A Large Nugget of Silver.

A mass of pure silver, weighing sixty-five pounds, it is stated, was lately found in one of the mines in the Lake Superior region.

Cold.

At one time it was thought that cold was some particular substance, a sort of nitrous particle floating about in space, but modern science has clearly proved that cold is a negative result from the absence of heat; much in the same way that darkness is the absence of light. Our ideas of hot and cold are formed by comparing the temperature of things with that of our body; when above the heat of the body we say they are warm or hot, and when below it we say they are cold.

The changes of temperature are measured with an instrument called a thermometer, (beat measure,) invented in the year 1600, by Santorio, of Padua; it consists of a glass tube, filled with quicksilver, which contracts with the subtraction of heat, and expands with its addition, sinking in the tube when it is cold and rising when it is hot. In England this instrument is marked like a rule into 212 divisions, called degrees. If we make a mixture of snow and salt, and place the thermometer in it, the quicksilver stands at 0°, or zero, on the scale. Ice begins to melt when the mercury points 32°; the heat of a fine summer's day is about 70°. The warmth of the human body is marked by 96; this is called "Blood Heat." If the rule be placed in boiling water the mercury stands at 212°. We daily witness the effects of heat between these extremes, and are pretty familiar with it up to the temperature of a blast furnace. But we have further to speak of cold, and of those effects which take place when there is, as it were, an entire absence of any heat whatever.

For every mile that we leave the surface of our earth the temperature falls 5°. At forty-five miles distance from the globe we get beyond the atmosphere, and enter, strictly speaking, into the regions of space, whose temperature is 225° below zero; and here cold reigns in all its power. Some idea of this intense cold may be formed by stating that the greatest cold observed in the Arctic Circle is from 40° to 60° below zero; and here many surprising effects are produced. In the chemical laboratory the greatest cold that we can produce is about 150° below zero. At this temperature carbonic acid gas becomes a solid substance like snow. If touched it produces just the same effect on the skin as a red-hot cinder; it blisters the finger like a burn. Quicksilver or mercury freezes at 40° below zero; that is 72° below the temperature at which water freezes. The solid mercury may then be treated as other metals, hammered into sheets, or made into spoons; such spoons, however, would melt in water as warm as ice. It is pretty certain that every liquid and gas that we are acquainted with would become solid if exposed to the cold of the regions of space. The gas we light our streets with would appear like wax; oil would be in reality, "as hard as a rock;" pure spirit, which we have never yet solidified, would appear like a block of transparent crystal. Hydrogen gas would become quite solid, and resemble a metal; we should be able to turn butter in a lathe like a piece of ivory; and the fragrant odors of flowers would have to be made hot before they would yield perfume. These are a few of the astonishing effects of cold. SEPTIMUS PIESSE.

London, 1857.

Transplanting Large Trees.

A correspondent reports a perfectly successful attempt to remove a considerable number of shade trees to surround a dwelling, each having attained about twenty years' growth. They were Norway firs, Balm of Gileads, hemlocks, larches, horse chestnuts and weeping willows—fifteen in number, each from 35 to 45 feet in hight. They were all cut out with a ball of earth in a frozen state, and every tree was delivered without damage to trunk or limb. The cost—a part having been conveyed on wagons and part on sleds—was from $50 to $100 per tree, warranted to thrive. It is yet too soon to judge the effect on their future growth, but we presume, from the success of other similar efforts, even with larger trees, that they will scarcely suspect they have been moved. It is considered important, under such circumstances, to place each tree in the position relatively to the points of the compass as it stood before.

Defeat of Patent Extension Schemes.

The following, from the Washington correspondence of the Philadelpbia *North American*, comments very properly and forcibly on the prospects of reviving and renewing two of the antiquated monopolies which have been urged upon Congress:—

"The vote in the Senate, yesterday, upon the applications of Hussey and McCormick, for the extension of their reaper patents, ought effectually to settle their pretensions now and hereafter. McCormick's original patent being obtained before the existing law, covered all the elementary and substantial principles belonging to former inventions. Still it needed something to complete its practical value, which was found in the two special patents under which he is now working, and realizing a profit of at least $150,000 a-year.

Not satisfied with this success, he has followed Congress for years past, asking a revival of the original patent, which was declared to be public property in 1848. That concession would subject every manufacturer who has applied his own improvements to the reaper, to such a tax as McCormick might impose.

There were 50,000 machines made last year, and a fee of $20 each would insure him a million a year, independent of his income from existing patents. Hussey's reaper stands upon nearly the same principle, though the case has more meritorious circumstances connected with it. Merely technical pleas have been put in by both parties, to carry their point before Congress, and though repeatedly rejected, they have turned up again and again, until their selfish importunity has become both provoking and insulting. It is now hoped that they have bored Congress for the last time; for even some of the members who were disposed to be friendly, have been disgusted by the obtrusive pertinacity with which the object has been pursued. It is estimated that a thousand or fifteen hundred of these reaping machines were used in Pennsylvania during the past year, and that the number will be largely increased during the present one The subject is, therefore, one of interest to the people of the largest wheat-growing State in the Union."

Mysteries of Boiler Explosions.

A correspondent has a large tan yard, and a steam engine attached. The regular attendant was off one day, and the firing was entrusted to an Irishman. One of the workmen happened in, luckily, at an early hour, found the safety valve loaded down with bricks, stones, and what not, and the steam fizzing away at a great rate. He released it, and called the Irishman to account. "An sure," says he, "the stame was all going to waste" If it had burst, there would probably have been conclusive evidence of mysterious explosive gases, electricity, or something of the kind, as the cause.

A New Agricultural Business.

In Piesse's "Art of Perfumery" there is thrown out an idea which is exceedingly pleasing. It is embodied in these words:—"We desire to see flower farms and organized perfumatories established for the extraction of essences and the manufacture of pomade and oils, of such flowers as are indigenous, or that thrive in the open fields of our country. Besides opening up a new field of enterprize and good investment for capital, it would give healthy employment to many women and children. Open air employment for the young is of no little consideration to maintain the stamina of the future generation."

Valuable Door Lock.

Considerable attention has been attracted to the lock on the street door of the house of Dr. Burdell, who was recently so mysteriously murdered in this city. It is Butler's Rotary Lock, the best invention in this line extant The form applied in this instance is capable of being set in several different conditions, at pleasure, in one of which, most in use, it is almost or quite burglar-proof, although opened with the greatest possible ease by a flat key not bigger than a 25-cent piece. We have two of them in use, and can speak authoritatively in their praise. They are manufactured by Valentine & Brother, of this city.