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**WHAT CAN BE DONE FOR INVENTORS.--ADVICE  
GRATIS AND ADVICE FOR PAY.**

For the information of Inventors, we would state that it is the custom, at the office of this paper, to examine models or drawings and descriptions of alleged new inventions, and to give written or verbal advice as to their patentability, without charge. Persons having made what they consider improvements in any branch of machinery, and contemplate securing the same by Letters Patent, are advised to send a sketch or model of it to this office. An examination will be made and an answer returned by early mail. Through our Branch Office, located directly opposite the Patent Office in Washington, we are enabled to make special examinations into the novelty and patentability of inventions. By having the records of the Patent Office to search, and the models and drawings deposited therein to examine, we are enabled to give an inventor most reliable advice as to the probabilities of his obtaining a patent, and also as to the extent of the claim that it is expedient to set up when the papers for an application are prepared. For this special examination at the Patent Office we make a charge of Five Dollars. It is necessary that a model or drawing and a description of the invention should accompany the remittance.

The publishers of this paper have been engaged in procuring patents for the past eighteen years, during which time they have acted as Attorneys for more than TWENTY THOUSAND patentees. Nearly all the patents taken by American citizens in FOREIGN countries are procured through the agency of this office.

Pamphlets of instructions as to the best mode of obtaining patents in this and all foreign countries are furnished free on application.

For further particulars as to what can be done for inventors at this office, see advertisement on another page, or address

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**BREECH-LOADERS TO BE ADOPTED.**—The Government has appointed a commission of seven military officers, to meet at Springfield Armory on the 4th of January, for the purpose of testing breech-loading carbines and muskets, in order to select the best for army use.

**PROFESSOR RANKINE ON EXPANSION.**

We have the pleasure of laying before our readers in this number a communication on Expansion, from W. J. Macquorn Rankine, LL.D., of Glasgow University. Among the eminent masters of science, the two who have probably devoted most labor to the study of steam, are Regnault, of France, and Rankine, of Scotland; and there can be no higher authority on all questions relating to this department of physics than Professor Rankine. In this communication, the effects produced on the temperature and tension of steam by its expansion under various conditions are most clearly and distinctly stated.

It will be seen, that Professor Rankine says that steam, in expanding, without doing work, is slightly superheated; thus ratifying our reasoning on this point, and contradicting the conclusions of Mr. Isherwood in regard to condensation from "expansion *per se*."

In going over so much ground in a short newspaper article, of course it was necessary to condense the several statements to the utmost, and while we admire the terseness, we cannot help wishing for a fuller discussion of some of the positions. From some of Mr. Tyndall's remarks we should suppose that he would take the ground that steam in escaping through a safety-valve performs precisely the same amount of work, in disturbing the atmosphere and in other ways, that it does when it pushes a piston before it in a loaded engine. But Professor Rankine says that in the former case it does no work, and is superheated, while in the latter, it performs work, and is partly condensed.

In Mr. Isherwood's experiments, as well as in those of Messrs. Hecker and Waterman, it was found that from 8 to 45 per cent. of the steam was condensed in the cylinder, without doing work. This condensation takes place even when the cylinder is surrounded by a jacket of hot steam, the cooling not being effected by the conduction of heat through the walls of the cylinder, but by the abstraction of heat from the interior surface, in re-evaporating, during the exhaust, the water formed by condensation during the previous stroke. Should the fact of this large condensation be confirmed by other observers, it will be a very important matter to be taken into account in the practical application of Professor Rankine's principles to working engines.

Ought this condensation to be considered, or ought it not, in the third case cited by Professor Rankine, where steam expands and performs work, being maintained exactly at the temperature of saturation? It is said that the circumstances of this case are practically realized in many actual steam engines, as is shown by the agreement of their performance with the results of calculation. Though the performance of the engine agrees with the calculated power of the steam operating in the cylinder, what would be the agreement if the calculation was based on the whole quantity of steam formed in the boiler?

It was from the assumed disturbance of the pressure in the cylinder of a steam engine by this condensation and re-evaporation, that we supposed this instrument fails to furnish data for determining the theory of expansion. Though indicator diagrams give a good approximation to the whole work done, if from 8 to 45 per cent of the steam is condensed without doing work, the work done is not a very close approximation to that which the whole of the steam would perform if it were all utilized.

The occurrence, however, of this large condensation needs confirmation by other observers before it can be accepted as fully established.

In the mean time, it is exceedingly satisfactory to have the world's present knowledge of steam so briefly and distinctly set forth. Steam in expanding without doing work is superheated, and when Messrs. Joule and Thompson have ascertained the rate of superheating, we shall have a complete theory of expansion, which will supersede the calculations based on the Mariotte law and the hyperbolic curve.

**COPPER IN SPAIN.**—M. Tribut, a French mining engineer, has lately discovered a very rich vein of cobaltiferous copper, containing nearly 9 per cent. of oxide of Cobalt, near Oviedo, in Spain. He has entered into an agreement with an English house to take nearly the whole produce of his mines,

**RETROSPECTIVE.**

There is nothing more illustrative of the national energy and genius than the indomitable spirit exhibited under adverse circumstances. If in any other country than our beloved America a faction should arise and threaten the national existence, the plow would stand idle in the furrow, the threads of the loom swing listlessly from the frames, the anvils clink only to the sharpening of swords. The arts have not languished with us though the war still goes on. No very great inventions have been introduced during the past twelve months, but in that time old ones have been well tried and not found wanting.

The turret system for iron-clad vessels of war, against which so much has been written, has proved itself of paramount importance, and signal victories have been gained over our enemies through its adoption.

The utilization of the products of combustion, as applied to air engines, has been perfected in Roper's machine, and a very useful addition made to the list of prime movers.

In the matter of working heavy guns on shipboard we have great superiority over foreign powers. Two men can now handle a 20-ton gun, or heavier, with as much ease as a field piece in battery is maneuvered, and that though the ship be rolling at any angle. When a gunner can stand on his feet, these huge cannon can be worked. The system is the invention of Capt. John Ericsson, and patents were taken out on it through this office.

In the beautiful art of photography some progress has been made during the past year. The distinguishing improvements relate to the printing process. Mr. Swan, of England, has brought to great perfection the plan of carbon printing, by which the salts of silver are wholly discarded. Pictures superior in artistic effect to the silver prints, more permanent, cheaper, and capable of greater variety of tint and tone, are thus produced. Another improvement which has attracted much attention is that of Wotheby, of Germany. He prepares the paper for printing by pouring upon its surface a collodion which contains a few grains of the salts of uranium, and also of silver. Very beautiful pictures are made on this paper, and some of the inconveniences of the ordinary method of silver printing are overcome. Both of the above improvements have been fully set forth in our columns.

The extension of the electric telegraph over Russian America, binding it to this country, although not an invention, is one of those great enterprises which will open up new countries to the influence of civilization, and tend to dissipate ignorance, the twin brother of barbarism.

New textile fabrics are being experimented with; new substances for paper making are being tried, but come into use slowly, although manifestly economical and valuable.

In the art of war, very much has been done, and is doing, to render our nation superior to all others. Cannon of large caliber have been introduced, and are making way, in spite of the obstacles thrown in their path by learned and unlearned. Submarine warfare, as relates to the use of torpedoes, has also been experimented with, and the gallant achievement of Lieut. Cushing, with Chief Engineer Wood's apparatus, is an evidence that practical results can be obtained.

The adoption of breech-loading small arms to a considerable extent is also a desirable conclusion arrived at, and the experiments with wrought-iron cannon now in progress will doubtless end in the adoption of them for certain purposes. In hooped ordnance we have the Parrott gun, of which the Chief of Ordnance says that it has proved itself to be a most excellent weapon, superior in general to all others.

The development of petroleum has attracted the greatest attention during the past twelve months, and has become an established industry. The geographical extent of the country in which petroleum is found is known positively to be of immense area. Much value will always attach to it as a staple article.

Of minor inventions the number and character are too great for special mention. The list of patent claims, published weekly in this journal, affords convincing proof that inventors are not idle. There are many things which will never become celebrated in the world that now employ hundreds of tons of iron