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PROGRESS OF SCIENCE—THE PRESS AND PATENT LAWS.

N mental grasp and acuteness of intellect, in architecture, sculpture and great works of civil engineering, the ancients were not our inferiors. To whatever subject the Greeks and Romans devoted themselves intently, they arrived at great perfection; and, perhaps, if their minds had been directed to the necessity of inventing some great motive agent, the improved steam engine would have been the work of Archimedes instead of James Watt. But, although the human intellect has been the same in nature and power in all ages, yet it is accumulative in knowledge, and this leads to progress in invention. This is the reason why there are many arts and sciences in our day that were never heard or thought o by our ancient progenitors. It is an old and true saying that "Necessity is the mother of Invention," for, whenever a want is felt, the deep aspirations of nature are moved to supply it—and usually with success; hence, invention is truly the offspring of necessity.

Very great improvements have been made in science and art in our day, but the subject of greatest wonder connected with them is their rapidity of development. As much progress has sometimes been made in a few months in the present century, as in hundreds of years in the "olden times." We have no difficulty in arriving at the cause of this; it is the combined influence of the press and patent laws. These are the grand agencies for stimulating and encouraging invention, and thus impelling the car of Progress "onward with impetuous speed." Watt did not invent an engine for his own special use; Fulton a steamboat, Whitney a cotton gin, or Morse a telegraph; these were invented to supply public wants, and the press is the great agent for making these wants known. The *scientific press*, as a speciality, is the handmaid of progress in the useful arts. Of this, there can be no doubt—it is a fact founded on reason, and exemplified by the experience of every day life. The SCIENTIFIC AMERICAN, as a personality, can testify to the truthfulness of these statements being corroborated by its experience of the past fifteen years. During that period, more valuable inventions in mechanism have been made than in thousands of years before the art of printing was known. The art of printing, by accumulating knowledge, permits every new generation to move forward from a higher elevation, because men of genius and inventors are now furnished with a knowledge of the discoveries made by others before them, and they are thus saved from wasting efforts in a wrong direction. It is thus that the scientific press is an economizer of public labor, as well as a teacher and friend of science and art.

One of our great specialities is the encouragement of inventors by patent laws as a just national institution for their protection. It requires no argument, because it is a self-evident fact, that the rapid advancement which our country has made in science and all the arts is due, in a paramount measure, to our patent laws. In a recent article in the London *Mechanics' Magazine*, on the manufactures of Switzerland, it says:—"It has been truthfully remarked that Switzerland has produced no eminent inventors. In accounting for this, Mr. Barnby—the British Secretary of Legation in that country—thinks we must look for the cause of this in the fact of there being no patent laws." We believe that no other fact can be adduced for this, and from it we derive a most important lesson. Switzerland is distinguished for the skill of her artists and mechanics in a great variety of manufactures; and, for intense industry, her people surpass those of every other nation. But they have made no great inventions; they have derived their improvements mostly from France and Germany, where inventions have been encouraged by patent laws.

All the great inventions which have been evolved by our countrymen were protected by patents. It was under the encouragement of our protective laws that their authors labored on in hope and with unremitting toil in the accomplishment of their grand designs. We believe, we are warranted in making the assertion that our distinguished inventors could not, and would not, have produced those improvements which have given them wealth and fame, unless they had been encouraged and protected by patent laws. In commencing a new volume, we look forward with animated hope to still greater achievements in science and art than have yet blessed the earth, because the mighty agencies of the Scientific Press and patent laws exert a more extended influence for good than they ever did before.

ECONOMY OF STEAM.

Everything that relates to this subject is of general importance, because the steam engine is so universally and diversely employed to subserve the purposes of commerce and the arts. It would naturally be expected that, with the advancement of knowledge and discovery, the opinions of scientific and practical men as to the best methods of applying steam would be more correct and uniform than heretofore. This, however, is not the case; the opinions of engineers and others who have devoted attention to this subject never were so various as at the present moment. Some believe that there is no gain in working steam expansively; while others as strongly contend that a saving of 50 per cent of fuel may be secured by expansive working. One believes that high-pressure steam is of vast advantage; while another asserts that low-pressure steam is equally economical, and much safer. Some believe that superheating the steam effects a great saving; while others contend that combined superheated and common steam surpasses all other conditions and arrangements for economy. A majority of those who are held to be high authority in engineering matters have, of late years, also advanced the theory that steam, when expanding in a cylinder, condenses into water in proportion to its rate of expansion, while there are a few who deny that such condensation takes place. These opinions are both various and contradictory; yet, among those who entertain them, a uniform sentiment prevails as to the small amount of power obtained in proportion to the fuel consumed for engines, thus admitting that there is great room for improvements.

As it regards the working of steam expansively, a paper was recently read before the Polytechnic Association, in which it was stated that experiments conducted at the Metropolitan Mills afforded evidence unfavorable to the advantages which are held to be gained by expanpansion, and we know that several engineers entertain similar views. That there is a decided gain to be obtained by working steam expansively is very easy of calculation. Thus: supposing we use steam of 80 lbs. pressure in a cylinder, and cut off at one-fourth of the stroke, we obtain an average pressure of 41.65 lbs. Unless there is a great loss sustained by condensation during expansion, it is evident, therefore, that there must be a saving of about 50 per cent of the steam.

The conclusion appears inevitable that, in every case where steam has been employed expansively without any apparent benefit, there has been some defect in the engine—such as unprotected cylinder and pipes or leaks by the valves. The new engines of the vessels belonging to the Pacific Mail Steamship Company (British), in which the system of expansion is carried out in a very superior manner, do the same work as the old engines, with about one-half the coal. We have been informed that one of the chief-engineers of the United States Navy has made trips in one of these steamers, for the purpose of acquiring information regarding their steam economics, and that he has presented a most able and favorable report on the subject to the Naval Board at Washington.

With regard to the employment of high-pressure steam, there is great economy when worked expansively. If steam, at 50 lbs. pressure, is cut off at half-stroke, it will exert an average pressure of 37.5 lbs.; while the same weight of steam at 25 lbs. pressure, without being cut off, will operate with a pressure of 12½ lbs less. In the former case, the steam is expanded in the cylinder; in the latter, it may be said to have been expanded in the boiler. If it absorbed power to generate steam in proportion to the pressure in the boiler, no saving could be effected in using it at a high pressure. In practice, it requires a little more fuel to raise steam under high than low pressures; but the gain of power is greater than the increase of fuel. The boiler is the source of power, and it is evident that, with high pressure and expansive working, there must be great economy, unless condensation takes place in the cylinder independent of pressure and temperature, which does not seem possible.

The liquefaction of steam by simple expansion is a new theory, claimed to have been discovered about the same time by Professor Rankine, of Scotland, and Clausius, of France. The former gives formulæ for calculating the amount of condensation in proportion to the expansion; and yet there has not been a single fact adduced in proof of such liquefaction of the steam. Steam does not liquify in any boiler until its temperature is lowered below 212°, a result which does not take place by expansion while the pressure is maintained above that of the temperature.

Various ideas are afloat regarding the meaning of *superheated steam*; but it will simplify the subject to adopt the definition of Mr. J. Frost, who, above all other men, deserves to be called its inventor. According to his description, it consists of "common steam subjected to a higher temperature than itself out of contact with water." By allowing steam to flow from a boiler through tubes exposed to a high temperature in the smoke-stack or in the furnace, it becomes superheated. The employment of such steam in cylinders in place of common or saturated steam effects quite a saving of fuel, and it is becoming quite common in England on board of steamers.

Another condition or method of employing steam, lately introduced, is the "Wethered system." It consists in using superheated and common steam in combination in the cylinders of engines. Mr. J. Wethered, of Baltimore, recently read a paper on the application and advantages of his system before the Institution of Civil Engineers (England), and on the 3d of April last an entire evening was devoted to its discussion by the members. As applied to the British screw frigate *Dee*, it was stated that the result of 20 experimental voyages gave, with combined steam, 500 H.P. in the engine; with superheated steam alone, 409 H.P; and with common steam, but 404 H.P. It was also stated that the combined steam had also been applied to a non-expansive engine, when the consumption of fuel fell from 35 to 24 cwt. per week. It was admitted by the members of the institution that the "Wethered system" effected a great saving of fuel in the steamer *Dee*, but it was held that the steam should not be superheated more than 100°, and that all the extra caloric it required was just a sufficient amount to permit common steam remaining dry to the end of its required expansion. In closing the discussion, it was stated, as the general opinion of the members, that the practical introduction of the system of superheating steam in England was greatly owing to the exertions of Mr. Wethered. He had succeeded in moving the British Admiralty when an English engineer could not have been so successful. This was also a subject of congratulation to them, as it was desirable, at all times, to give the greatest encouragement to foreigners, so as to attract the best talent.

Viewing the question of steam economics from various points, it appears evident that a great saving is effected by using high-pressure steam, superheating it, and then working it expansively in the cylinder. Boilers can be made to withstand a pressure of 100 lbs. per inch as easily as 20 lbs.; therefore, safety depends altogether on the construction of the boiler. A few years ago, it required about 6 lbs. of coal to a horse-power in steamships, but the *Persia* steamer consumes from 3.92 lbs. to 4.2 lbs. per horse-power now; while some steamers, built within three years, in which high-pressure and expansive-working are carried out, do not consume over