

INVENTIVE PROGRESS—PAST AND FUTURE.

Before proceeding from one stage to another of a long journey, it is prudent to arrange the knowledge that has been acquired by past experience, that it may be applied profitably as a guide for the future. Thus, at the commencement of another New Year of the SCIENTIFIC AMERICAN, we may be benefitted by taking a rapid survey of the past and accepting its lessons. Like the granite pier which supports the lofty arch over which a nation's commerce may be carried, so the metal *iron* is the buttress and support which upholds the procession of the modern industrial arts. Without this metal, steam engines, steam ships, railways, mining and modern manufacturing machinery, would still have been unknown. Every improvement in the manufacture and application of iron—either cast, malleable, wrought, or as steel—is therefore of vast consequence. Cast-iron is a valuable material, because it may be melted and molded in any suitable form. In this state, however, it is very brittle; hence to obtain strong wrought iron, it has to undergo several expensive operations, and in this state it cannot be melted and cast. By the "malleabilizing" process castings are subjected for several days to a high heat in the presence of an oxide, being thus made more tough, while retaining their original form; but this is a tedious and troublesome operation. Our foreign exchanges chronicle the production of good malleable cast-iron in Glasgow, Scotland, by which castings are produced direct from the molten metal, and are nearly as strong as forgings of wrought-iron, and for many important purposes will supersede it.

Until recently no fine commercial cast-steel had been made in America, but now its manufacture is carried on with success in Pittsburgh, Pa., and at Rockaway, N. J. In many respects, however, we are still far behind European steel manufacturers, more especially in the production of large articles. Krupp, of Prussia, produces castings and forgings of steel in such masses that the efforts of our steel manufacturers, compared to his, are like the efforts of Lilliputians to Titans. Expensive apparatus, ponderous engines and mechanism, and large capital are necessary to conduct the applications of steel upon a large scale. But with patience and perseverance, American steel manufacturers and fabricators of articles in steel should advance to an equality with the first in the world. The production of steel from pig iron, by what is called the "Bessemer process," is rapidly extending in Europe. This metal is employed for making tires for locomotive wheels, and is coming into general use for rails. After careful experiments with iron and steel rails, it has been found that the latter are about five times more durable than the former, and several great railway companies in England have adopted them exclusively. Such rails will effect a great saving in the cost of maintaining railways, and we may expect to see them come into extensive use in America. One establishment in Troy, N. Y., is engaged in the manufacture of this metal for such purposes.

A great impetus has been given to the manufacture of thick American iron plates for war vessels, but too little attention has been bestowed upon the production of long and broad thin plates for merchant steamers. This is undoubtedly owing to the slow progress of mercantile iron ship-building among us. But as steel is far superior to iron for the thin plates, used in building merchant steamers, much attention should be devoted to this art. Two steel vessels were lately launched at Liverpool, one of 1,271 tons, the other of 1,491 tons burthen. As the relative strength of this metal in plate compared to iron is as 8 to 5, the weight of steel used in the vessel of 1,271 tons was but 500 tons, whereas, had it been built of iron it would have been 800 tons. A great iron steamship, like the *Fersia*, if built of steel instead of iron, could carry double her present cargo. For composite girders of bridges, boilers, &c., steel should take the place of iron, because greater strength can be secured with the same weight of metal.

The greatest feat of engineering in the form of tunneling ever attempted, is that of cutting seven miles through Mont Cenis, in which an ingenious mode of drilling has been adopted by the Italian engineers. They have applied the power of water from the snow-capped mountains to compress air, by the

use of pumps; then conveying it, by flexible tubes, into the tunnel, to supply fresh air to the miners; and no vertical shafts are sunk. We suggest the employment of compressed air, in this manner, to operate excavating machines in our coal mines. All danger from fire, as compared with steam, would thus be obviated, and the mines ventilated at the same time.

Silk manufactures are on the increase among us. Silk fabrics are now made at Hartford, Conn., and at Cohoes, New York, and a manufactory has gone into successful operation in the Eastern District of Brooklyn. A large number of articles which were lately made in France, and imported, are now manufactured successfully in the vicinity of New York.

Less attention has been devoted to the cultivation of flax by our farmers than we anticipated. Owing to the scarcity of cotton and its high price, remunerative rates could have been obtained for very large quantities of flax fiber, and for several years to come it may be cultivated as a profitable crop. In connection with this subject, we urge the cultivation of cotton in Delaware and Maryland, as it is a historical fact that American cotton was first successfully raised in these States.

Great progress has been made in railroad construction during the past year. Several hundred miles of the Atlantic and Great Western Railway have been completed, and the work is now going rapidly forward, which will connect New York with the Mississippi by a continuous broad-gauge line. It is contemplated that it will yet be carried to California, when the Atlantic and Pacific Oceans will be linked together by a splendid trunk line, reaching across the entire continent.

The application of injectors to the boilers of locomotives has become common. Some progress has been made in applying steam to city railroads, but the advance is very limited, owing to the ignorant prejudice of various corporations against steam, as being more dangerous than horse power.

A new telegraph has been adopted for army operations. The current is magneto-electric, generated by turning a small crank. Neither battery nor acids are required; the apparatus is compact and convenient, and may be carried in a soldier's haversack.

It is gratifying to know that a new Atlantic cable is being manufactured in London, and that measures are now in progress for laying it next summer. So many improvements have been made in the construction of submarine cables within a few years, that hopes are now entertained of establishing an Atlantic telegraph line.

A remarkable development has taken place during the past year in the American petroleum trade. Over twenty-four millions of gallons have been exported in twelve months, and about an equal quantity has been retained for home use. To a moderate extent petroleum has been successfully applied for making gas in small apparatus; but for the supply of cities it is more expensive than coal. A number of experiments have also been made to apply it as fuel under steam boilers, the high price of anthracite having stimulated efforts to obtain a cheaper substitute; but until petroleum can be sold for about six cents per gallon, it will not be capable of competing with coal for fuel.

The manufacture of syrup from sorghum has become an established business in the West, and great improvements have been made in the apparatus for evaporating the juice of the plant.

Sewing and knitting machines, clothes-washers and wringers have become common in most households. There is still great room left for improvement in inventing and adapting several simple and inexpensive machines for domestic use, especially for farmers; so that many of the natural products of the farm, which are now sold in the raw state, may be manufactured into articles for sale, during weather that is too stormy for out-door labor. Flax cordage and cloth, and various woolen fabrics, might be manufactured profitably by many farmers, in the winter season. In Italy and Switzerland, silk and flax articles and watches are made by the families in the rural districts at seasons when they cannot labor in the fields. With convenient braiding, sewing, knitting, spinning, weaving and other machines, operated by hand power, or with a portable steam engine or water wheel driven by a running brook, adjacent to the cottage, a farmer

could combine mechanical and manufacturing operations with agriculture. Such establishments, under what is known as "the factory system," have many objectionable features; hence domestic manufactures should always be encouraged. Plowing by steam power has become common in Europe, but it has not made much progress with us. The great scarcity of labor in the agricultural West should give an impetus to the application of portable steam engines to agriculture.

Two new and useful alloys have been added to the list of those already well known. These consist of "Aich's Austrian metal, and Aluminum bronze; the former consisting of 67.63 parts, by weight of copper; 40.22 parts spelter; 1.86 parts iron, and about .84 parts of tin: the bronze consists of 90 parts copper and 10 of aluminum. Aich's metal is about double the strength of common gun metal, and the bronze, which is of a beautiful gold color, is nearly as strong as wrought-iron. It is too expensive yet for making the different parts of working machinery, but for ornamental articles it is highly prized.

The manufacture of watches, chiefly by ingenious and delicate machinery, has become an established and successful American art, and it is probable that, instead of importing watch movements from the Old World, we shall ultimately export them to Europe; and, like American clocks, they may become time-keepers to the denizens of all lands.

We have thus alluded to various topics relating to manufactures, inventions and commerce, and might have extended the list of subjects to much greater length; but we have said sufficient to arrest the attention of those who are devoted to progress and improvement, so that a fresh and intelligent start may be made for the new stage of life's journey in 1864.

MANUFACTURE OF COAL OIL.

The manufacture of oil from coal, by distillation, has been extinguished in the United States by the large supplies of cheap petroleum. But we notice by our foreign exchanges that coal oil is manufactured upon an extensive scale in Scotland, and the business there is upon the increase, competing with imported petroleum. If our oil wells were to cease flowing, the manufacture of coal oil would be resumed, of course; because there are extensive beds of cannel coal in Pennsylvania, Ohio, Kentucky and Virginia, from which illimitable quantities of this oil could be made. There are several points of difference between the rock oil and the coal oil. From the coal, pure benzole is obtained, and from this product the beautiful aniline red, crimson and purple colors so much admired are manufactured. Such products have not been obtained from petroleum, for if pure benzole exists in the natural oil, the quantity is so limited that it has not been appreciated. The benzine of petroleum is a different substance from the benzole of distilled coal. Another product of distilled coal, differing from that of petroleum, is its heavy oil that is used for lubrication in Europe. Oils of different specific gravities are derived from petroleum, but the heaviest is said to be inferior to that obtained from coal for lubricating machinery. A great improvement in the distillation of coal has lately been effected in Scotland. It consists in admitting superheated steam of a very high temperature into the vertical retorts while distillation is going on. The product is nearly doubled, the oil clarified, the disagreeable odor modified to a certain extent, and the retort kept clean.

PATENT OFFICE REPORT FOR 1862.—The engravings for the above work have been completed by Messrs. Jewett & Co., of Buffalo, to whom we are under great obligations for proof sheets. It is almost needless to add that the artistic execution of these illustrations is characterized by that superior excellence which marks the generality of the work done at the establishment of Messrs. Jewett. We have also received from them their sample pamphlet of line engraving, which, for beauty of typography, will, we are confident, command the attention of the printing fraternity.

The rifled muskets made by the "Savage Arms Co.," Middletown, and rejected by the government inspector, are sold to a New York concern for \$7 per gun more than the Government price. It is not a serious job for the Company, therefore, if the guns are all rejected; and Government probably buys them of other parties at an increased price.