The new shop is located within six minutes' walk of the railroad depot and within ten minutes' walk of the business center of Providence. At these works there are facilities for manufacturing all sizes of engines, from ten horse power to one thousand horse power. The shop was arranged with reference to the handling of materials and parts of engines with the greatest facility. The lathes, planers, and other machines are placed so that, as the work progresses toward completion, it is moved over as little space as possible, in passing from one machine to another. This complete and careful arrangement of tools results in a great saving of labor and facilitates the work.

The demand for the Harris-Corliss engine is such that one thousand horse power per month in engines of different sizes have been shipped from this establishment for many months consecutively. It is now a common thing to contract for engines of seven hundred and eight hundred horse power, and furnish pulley fly wheels thirty feet in diameter, eight feet face, the wheel alone weighing, when finished, one hundred thousand pounds. These immense wheels are made in sections, fitted and bolted together. They are mounted on a shaft supported in suitable journals, and turned by applying to their spokes toothed segments and driving by means of a pinion.

A good idea of the appearance of the machine shop of this establishment may be had from the lower view in our large engraving on the front page. Here are shown the various parts of the engines and the means of handling them. In one of the upper views is shown the blacksmith shop, in the other the pattern shop.

The accuracy of the work done in this establishment, as well as the excellent quality of the materials used, is attested by every engine sent out.

We found in these works engines in process of construction for all portions of the United States, and we were informed that many of them have been exported for use in foreign countries.

The great success of the Harris-Corliss engine lies chiefly in the simplicity and precise action of the governing elements; the governor is an independent mechanism, saddled with no extraneous load, and free to instantly respond to variations in the angular velocity of rotating parts. (The slightest variation in the angular motion of the shaft or fly-wheel is immediately appreciated by the governor, and a corresponding point of cut-off is instantly indicated.) "An automatic cut-off engine is one in which the volume of steam cut off in the cylinder is exactly proportioned to the steam pressure and imposed load, to automatically regulate the speed of the engine. If the load is increased, the piston stroke to cut off is lengthened; if the steam pressure is increased, the piston stroke to cut off is shortened, and *vice versa*, and the regulation of cut off for any stroke depends upon the conditions existing during that stroke. Thus each stroke of the piston and each semi-revolution of the crank possesses a perfect autonomy."

In the Harris-Corliss engine, when the steam port is opened for admission of steam to the cylinder no obstruction exists to the free flow of steam from the boiler, and when the connecting pipe is of proper size, with few bends and well protected from loss of heat by radiation, the initial pressure in the cylinder is within a pound or two of the pressure in the boiler. When steam flows into the cylinder the piston advances with a velocity proportional to the load on the engine and steam pressure, the motion of the piston is communicated to the crank, and from the shaft to the governor, and a point of cut-off is indicated for that stroke; the nearness of the steam and exhaust valves to the bore of cylinder, the prompt opening and instantaneous closing of steam valves, the rapid opening of exhaust and the tightness of valves under pressure, all contribute to the remarkable performance of this engine. The motion of steam and exhaust valves derived from the wrist plate is peculiar to this engine, and, next to the precise action of the regulator, has much to do with the high economy of performance.

A Large Cog-Wheel.

A cog-wheel, said to be the largest ever made in Paterson, N. J., has lately been finished. It is of iron, 20 feet in diameter, the periphery 10 inches wide, and it weighs 12 tons. It is designed for a sugar factory in Cuba, and is to be used for crushing the sugar cane. It will make only two and a half revolutions per minute.

HUSNIK'S plan for causing a chromated gelatine film to adhere to a zinc plate is to coat the zinc plate with a solution of three grammes of chromic acid in one thousand grammes of water; when the acid has acted upon the zinc, wash off the solution and first coat the plate with plain gelatine, and then with the chromated gelatine. Treated in this way the film is said to adhere very firmly to the zinc; but it must be kept dry before being used, otherwise a chemical reaction is apt to set in, by which the printing surface would be spotted.

AN extraordinary statement is made by the Chief Government Engineer of the Province of Liége in his trade report for 1878. He alleges that during last year a good deal of hardware manufactured in Belgium was exported to England, whence it was shipped to British colonies after the Belgian trade marks had been obliterated and replaced by spurious English ones. 1878 was the worst commercial year which Belgium has known since 1830.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT
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THE AMERICAN ASSOCIATION.

Notice has been taken in other columns of the general proceedings of the American Association at its Saratoga meeting. On the whole it was an enjoyable convention, well attended by members, and well supplied with papers, though no part of the proceedings may be described as of extraordinary interest or importance.

No great scientific discovery or invention, that the readers of the SCIENTIFIC AMERICAN would consider entirely novel, was brought before the meeting. The main results of Mr. Michelson's investigation of the velocity of light had already been made public. The details of his work, however, were known to but few, and his paper was justly regarded as of superior value and merit. Professor Marsh's address was a masterly review of a great subject, crammed with information which will give it permanent value. As a record of the bibliography of palæontology, as well as a history of the development of the science, the printed address has no equal in that field.

Major Powell's treatment of Mythologic Philosophy was not only intensely interesting and suggestive, but singularly original, and freighted with a wealth of information with regard to the mental conditions of American savages. No better evidence could be given of Major Powell's fitness for the great work he is engaged in under the auspices of the Smithsonian Institution.

Mr. Edison's researches in connection with the behavior of highly heated metals in vacuo are certainly promising: possibly they mark the opening up of a new department in the practical treatment of metals, as well as in scientific metallurgy. Whatever may be the issue of Mr. Edison's efforts in the direction of electric lighting, the results of his investigations are certainly important in furnishing valuable contributions to science.

We take great pleasure in laying before the readers of the SCIENTIFIC AMERICAN and the SUPPLEMENT full and exact reports of the papers and addresses mentioned, with others of value.

PATENT YOUR INVENTIONS ABROAD.

In a report to the Department of State on the International Machine Market recently held in Leipsic, Germany, the United States consul to that place calls especial attention to the national and personal loss which results from the too common neglect of our inventors to take out foreign patents. Not only is the direct export of American manufactures to Germany and other European states seriously diminished by such neglect—the manufacturers of those countries flooding the market with cheap and ill-made imitations—but, still worse, such imitations are often exported to neutral markets to compete with or ruin the sale of the genuine articles of American make.

The consul mentions several American inventions whose market in Germany has been spoiled by local imitations after a large trade in the genuine articles had been built up. He also instances one which, thanks to a German patent, has been able to command the field in spite of many local imitations. He says:

"There are twelve manufactories throughout Germany engaged in the manufacture of reapers and mowers, after the model of those constructed by W. A. Wood, of Seneca Falls, N. Y. But the Wood reaper and mower being patented in Germany, the imitators have avoided infringement thereon by a variation from the original. This variation enables Mr. Wood to keep the field in Germany with his machines, notwithstanding the fact that the imitations are offered at 40 per cent less than the original."

The moral is evident. A few years ago it did not matter so much whether the inventor's control of his invention abroad was secured or not. American products were little known in foreign countries and imperfectly appreciated; besides the cost of manufacturing here was so great that any considerable export trade was out of the question. But all that has been changed. Even if the article is one that cannot profitably be exported the right to manufacture it in any European state can be profitably disposed of in the vast majority of cases. The eagerness with which American inventions are snapped up by foreign makers liable to unlimited competition in the production and sale of them is evidence enough, were all other evidence lacking, that the exclusive privilege of manufacturing under a patent would be easily salable at a good price. There is much to be done, it is true, toward organizing, developing, and simplifying the means required for handling to the best advantage American patent rights abroad; but even now the possession of a good patent right in any of the leading European states is a valuable property. And foreign patents are much more easily obtainable than most people imagine. Excepting England and Russia the official fees for patents in Europe are now not very much greater than those in the United States; and when we take into consideration the value of the markets thus to be controlled, the costs become comparatively trifling.

For this reason we are forced to think that Commissioner Paine is misreported in a late dispatch to the *Evening Post*, in which he is charged with saying that American inventors quite generally prefer not to secure patents in Europe in consequence of the high and discriminating fees there exacted.

That American inventors do largely neglect to secure the advantages offered by foreign patent laws is evident enough; but it is not due, we think, to any deliberate balancing of cost and possible profit. More frequently the American in-

ventor utterly fails to appreciate the real value of foreign fields of operation. The opportunities offered at home are large enough to satisfy his ambition; and he does not know what he could do with foreign patents if he had them. The more enlightened of our inventors, however, are finding out the impolicy of such indifference to European markets; and before many years the neglect to take possession of them will form the exception and not the rule.

Our national redress, therefore, against the lawful appropriation of unpatented American inventions abroad, and the consequent loss to our national income, is rather through the enlightenment of our inventors by means of information such as the Leipsic consul sends, than through any attempt at retaliation by the exclusion of foreign inventors, as Commissioner Paine is reported as favoring. The *Post* writer says:

"The only practical measure of redress open to our government would be to adopt a scale of fees for foreigners to correspond with those charged to American inventors. This course, the commissioner thinks, would speadily bring about a desired change, as foreign inventors regard the American market as an exceptionally good one for mechanical devices, and are always anxious to take out American patents."

Possibly it might, but we should be the heaviest losers by the attempt. The expressed object of the American patent system is the advancement of the useful arts—the multiplication and perfection of American industries. To accomplish this end, inventions are encouraged by offering the inventor, for a term of years, the exclusive right to use, make, and sell his invention and its products. The nationality of the inventor has nothing to do with the matter. If his invention is new and useful we want the benefit of it; and we are more likely to reap that benefit by treating him fairly than by trying to exclude him or rob him. The circumstance that certain foreign governments do not show a corresponding willingness to accept the benefits offered them by American inventors is no excuse or reason for our imitating their unwisdom. The moment we look upon inventions in their proper light, as the bases of new industries and the improvement of old ones, all talk of retaliating against foreign shortsightedness in the matter of patent rights, by handicapping foreign inventors, is sheer nonsense. The best way to induce foreign governments to treat American inventors more liberally is to prove to them by our industrial progress the vital advantage of treating liberally all inventors, their own as well as ours.

Be that as it may, the fact remains that most European governments do now offer our inventors privileges that are worth securing, though at a somewhat higher cost than we are accustomed to here, and every year those privileges increase, and rapidly increase in money value.

GELATINE NEGATIVES.

Much success has of late attended the production of photographic negatives in which a substratum of gelatine is used as the vehicle to carry the sensitive silver instead of collodion. It was claimed, among other advantages, that the gelatine was cheaper than the collodion. It seems now to have been ascertained in England that for the damp climate of that country, at least, the gelatine negatives are unstable.

The film expands and contracts, under the varying degrees of atmospheric moisture, to such an extent that the usual varnish soon cracks and the surface is covered with a fine powder, while the surface of the gelatine retains the markings of the cracks, and the negative is spoiled. To prevent this loss of negatives, it is recommended that gelatine negatives be covered with a film of collodion and then varnished. The collodion has a greater expansive quality than the varnish, and does not crack. It perfectly preserves the gelatine negative. But inasmuch as collodion makes first-rate negatives, would it not be better to omit the gelatine altogether?

In the meantime we will suggest that the latest improvement in the production of gelatine plates—formulæ for which we have heretofore published—consists in adding a quarter of a grain of gelatine to the solution of bromide employed in precipitating the silver. This simple little change gives ease and certainty to the production of dry gelatine plates of the highest sensitiveness. This improvement confirms the suggestion of M. De Pitteurs, that the remarkable sensitiveness of gelatine plates is due to a chemical combination between the gelatine and silver which favors the action of light on the bromide of silver.

THE DISSOCIATION OF CHLORINE.

Employing the improved method of determining vapor densities, which he introduced last year, Professor V. Meyer, of Zurich, has lately subjected chlorine to a series of tests which strongly indicate a compound character for that hitherto supposed element. As described in *Nature*, the apparatus employed is also extremely simple, and consists of a cylindrical bulb of about 100 c.c. capacity, sealed to which is a glass tube about 6 mm. in diameter, and 600 mm. long; this tube is widened out at the open end, so as to admit of the introduction of a caoutchouc stopper, and has a side tube, 1 mm. in diameter and 140 mm. long, sealed on to it about 100 mm. below the open end. The side tube is once bent nearly at right angles and the end slightly turned up, so that, when dipped into water, it will deliver gas into a graduated glass vessel inverted over it. For determinations at high temperatures the bulb is constructed of porcelain and is heated in a gas furnace; when operating at lower temperatures the bulb is heated either by means of a vapor bath or in a bath of molten lead. The operation consists in heating the bulb until it acquires a constant temperature, which is indicated by the non-appearance of air bubbles at the orifice of the side tube which is plunged under water; the stopper is then removed, the weighed quantity of substance introduced and allowed to fall into the bulb, the stopper quickly reinserted, and the end of the side tube then brought under the measuring vessel; directly air ceases to issue from the extremity of the tube, the stopper is removed, and the air thus collected is afterward measured in the usual manner. In the case of substances which undergo oxidation when heated in air, the air is first displaced from the apparatus by a current of pure nitrogen. In this manner the volume of vapor, measured at the atmospheric temperature and pressure, generated by a known weight of substance, is ascertained, and the density deduced from these data by a simple calculation.

Experimenting with chlorine the numbers obtained at a temperature about 620° C. agreed with those required on the assumption that the chlorine molecule has the formula Cl_2, which is that generally accepted. At higher temperatures, however, a diminishing density was determined, until at about 1,200° and above, the density was two thirds that obtained at 600°. In this respect the action of chlorine, when heated, is precisely like that of oxygen when passing from the condition of ozone to its ordinary condition. Two explanations are possible. Either what is regarded as the atom of chlorine is (like ozone) a compound of three subatoms, with the formula Cl_3 (instead of Cl_2 as commonly held), or chlorine is not an element, but a compound of at least two elements which are dissociated by heat.

In confirmation of the correctness of the latter supposition, there comes the report from Zurich, printed in the *Chemical News*, that Professor Meyer, in conjunction with Herr C. Meyer, has determined that in all probability oxygen is one of the components of chlorine. Still further, an unconfirmed report has reached *Nature* to the effect that the Messrs. Meyer have actually separated oxygen from chlorine. Should these reports be confirmed, the chemistry of the non-metals will enter at once upon a new era. In the communication to the Berlin Chemical Society, describing the experiments noted, the Messrs. Meyer state that bromine behaves like chlorine; and if chlorine has been dissociated, the rest of the group are likely soon to follow.

THE NORTHWEST PASSAGE SUCCESSFULLY MADE.

The Swedish exploring steamer, Vega, of the Nordenskjöld expedition, arrived at Yokohama, Japan, Sept 2. The Vega was in excellent condition; all on board were well, and there had been no sickness or scurvy on board during the long Arctic winter.

The following report of the entire voyage, as told by Professor Nordenskjöld, was telegraphed to the New York *Herald*. The Professor says:

"We sailed from Gothenburg on July 4, 1878, and a four days' sail brought us to Tromsöe (a Norwegian port on an island of the same name), where our outfit of furs and necessaries for the high latitudes was completed. Here we were joined by the companion steamer, the Lena. On July 25 both vessels sailed from Tromsöe, passed through the Yugor Strait (south of Nova Zembla) on August 5. There was not a particle of ice to be seen between the Waigatsch (Vaigatza, a Russian island) and the continent. The Kara Sea, hitherto dreaded by all sailors in the Arctic regions, was equally free from ice, and anchor was cast at Port Dickson, near the mouth of the Yenisei, on August 6.

STEERING NORTHEAST.

"After a three days' delay there the two steamers of our expedition steered northeast toward the dreaded Taimur land and the North Cape. The ice arrested our passage and we were compelled to remain at Tajoyr (Cape Taimur?) four days. On August 19, Tsejdekin, the extreme northern point of Asia, was reached, where a short rest was taken. The Vega coasted the peninsula, very little ice being encountered, and anchored at the mouth of the Lena River on August 26. To the northeastward were the islands of New Siberia, which we soon sighted, but were unable to explore because of the great field of ice that girt their shores. The mouth of the Kolwya River (latitude 69 deg. 30 min., longitude 161 deg. 30 min.), a broad estuary, was found open, and we hastened to make all possible progress eastward. Our difficulties soon began, however, and increased daily. We were delayed much with the ice between Cape Cook and Van Karema. We crossed Kolintsehm Bay on September 27 with comparative ease, but were imprisoned on the 28th near a Tchuktchi settlement (latitude 67 deg. 7 min. north, longitude 177 deg. 24 min. west).

THE WINTER IN THE ICE.

"We wintered in the pack ice at this point, one mile from land. The entire ship's company maintained the best of health and spirits. Not a single case of scurvy occurred on board. During the shortest day the sun was above the horizon less than three hours, and then only the upper limb was visible. At this point much time was devoted to interesting scientific and ethnographic studies. There were 4,000 inhabitants in the several villages near by, who subsisted by fishing and sealing. They are called the Tchuktchi, and are a very agreeable class of people for an exploring party to meet. They supplied the expedition with bear and reindeer meat. The cold was intense, averaging 36 centigrade (32.2 degrees below Fahrenheit.) The game was abundant in the spring, wild fowl being taken in large numbers. We were detained in the ice at this point 264 days, but were released on July 18, and passed East Cape into Behring Straits on the 20th. Such is the story of our voyage.

COMPLETE SUCCESS.

"I fully accomplished the object for which the expedition was sent out by Dr. Dickson—namely, a practical proof of the existence of a Northeast passage. Then the Asiatic coast was followed and St. Lawrence Bay was crossed to Port Clarence, Alaska. Thence we crossed to Koniyan, dredging carefully in order to determine the formation of the bottom of the sea, many specimens of the fauna and flora being obtained. The location, breadth, velocity, and approximate volume of the currents of the Arctic and Pacific Polar currents were charted and calculated. Having touched at St. Lawrence Island we next proceeded to Behring Island, where we received the first news from Europe through the resident agent of the Alaska Trading Company. The fossil remains on Behring Island are of immense variety. A new marine animal was here discovered, which we named *Rhytina stellari*. The Vega left the island on August 19, and had a pleasant voyage until August 31, when a severe gale was encountered, accompanied with lightning. During the storm the lightning struck and shivered the maintopmast, slightly injuring several men. We arrived off Yokohama at half past eight on the evening of September 2. All are well, and no deaths have occurred during the voyage.

PROSPECT.

"The Vega is the first vessel to make the passage, and I think the voyage from Europe to Asia by Behring Strait is certain and safe, with very little more experience of navigation in the Northern seas. From Japan to the mouth of the Lena River there are no difficulties in the proper season for experienced sailors. The Lena River taps Central Siberia, and a large prospective trade can readily be developed.'

Apart from the obvious commercial advantages to result from the outlet to Siberian trade, opened up by this plucky and successful voyage of the Vega, and the contribution to science made thereby, it is impossible as yet to estimate the probable good results of the expedition. If, as Professor Nordenskjöld believes, a safe and easy Northeast passage is demonstrated, its availability must be confined to two or three summer months at best—too brief a period for an established commercial route; and vessels which take the southern routes during ten months of the year, are not likely to venture into icy waters for a single trip, however much it may promise to save in distance. With good luck the northern voyage, say from England to Japan, might possibly be made in half the time now required, but instead of having open sea room for the most part, the trip would be mainly along a dangerous and inhospitable coast in a narrow channel between ice fields and foggy shores, with the ever imminent risk that northerly winds might at any time bar the passage with Arctic ice floes, and imprison the ship for an Arctic winter.

Under improbably favorable conditions the Northeast passage may prove a useful route between Western Europe and our Pacific coast; but it will require more than one successful passage—a two seasons' trip at that—to induce many shipmasters to go that way.

PLATINUM IN THE UNITED STATES.

Notice was taken some time since of Mr. Edison's circular letter of inquiry with regard to the possible occurrence of platinum in various parts of the country. Mr. Edison informs us that, so far, he has received some three thousand replies. Instead of being an extremely rare metal, as hitherto supposed, platinum proves to be widely distributed, and to occur in considerable abundance.

Before Mr. Edison took the matter in hand platinum had been found in the United States in but two or three places—in California and in North Carolina—and in these places it occurred but sparingly. It is now found in Idaho, Dakota, Washington Territory, Oregon, California, Colorado, Arizona, New Mexico, and also in British Columbia.

It is found where gold occurs, and is a frequent residual of gold mining, especially placer mining. Mr. Edison thinks he can get 3,000 lb. a year from Chinese miners in one locality. One gravel heap is mentioned from which a million ounces of platinum are expected. Hitherto the product of the entire world would not suffice to supply electric lamps for New York city. Now Mr. Edison believes that our gold mines will supply more than will be required. The possible uses of this metal in the arts, however, are so numerous that there is no danger of an oversupply.

In addition to platinum Mr. Edison finds, among the large number of samples received daily, many other valuable metals and minerals, so that his researches in this direction are likely to result in increasing greatly the resources of our country in respect to the rarer and more costly minerals and metals.

THE *Insurance World* thinks our present complicated system of fire alarm telegraph should be substituted by the much more desirable system of telephonic communication. The advantages, like an axiom, are so self-evident as not to admit of any elaborate demonstration.. One of the special features is that it will enable the person sending in the alarm to affix the exact location of the fire, and thus obviate the necessity of the firemen hunting for the exact point in the district at which their services are needed.