The answer to the second question involves the inquiry as to the true date of the English patent, within the meaning of our laws. The act says "that no person shall be debarred from receiving any invention or discovery, etc., by reason of the same having been patented in a foreign country more than six months prior to his application; provided, that in all cases, every such patent shall be limited to the term of fourteen years from the date or publication of such foreign letters patent."

The words "date or publication" should the Commissioner hold to be construed conjunctively, the phrase in effect meaning date *and* publication, and if there be a difference between the two, the latter time should be held as the true date. After a review of the practice in the English patent law, the Commissioner says: "As the invention in its perfected, completed form is not published until the enrollment of the final specification, as in fact much of the invention may be made between the time of the filing of the provisional and completed descriptions, it would seem that the date and publication which is to determine the limit of a patent in this country, should be the date of the filing of the complete specification."

The answer to the third question as to the limitation of the term of Cochrane's patent. Under the act of 1836 the inventor who took out a patent in a foreign country more than six months prior to his application in this country forfeited his right to an American patent. But if within six months, it took date from its issue here and ran the full term of fourteen years. The 6th section of the act of 1839 had no reference to those who made application within the six months. If made within the time, it bore the date of issue and ran fourteen years from that date. This view of the case is supported by citations from various decisions. It follows, therefore, that in the present case, Cochrane's application having been filed within less than six months from the time when his invention was "patented" in England, his patent is not affected by the provisions of the act of 1839, and must be corrected so as to run fourteen years from March 31, 1857, the date of issue.

OSBORN'S NEW TREATISE ON THE METALLURGY OF IRON AND STEEL.

A brief notice of this valuable and extensive treatise appeared in our last issue under the head of New Publications. It was our intention at that time to give it a review commensurate with its importance, but we find that to do this adequately would absorb more of our space than can be spared for the purpose. We shall therefore content ourselves with an outline of the character and origin of the work, and some extracts from its pages, one of which will appear in connection with this notice and some others in future issues. The author tells us in his preface that before he began the present work it was thought that a simple re-editing of Overman's Treatise upon Iron, would be sufficient; but that "upon a thorough examination it was found impossible to make that work meet the wants of those who would justly expect a recognition of the many important inventions and discoveries since its last edition was published, and who would not wish to read of anything as a theory which had become a fact, or of procedures which had passed away before the advance of metallurgic science. The author has therefore written a work entirely different in manner and matter."

The work is divided into four parts, the first of which treats of the theoretic metallurgy of iron. Under this head we are presented with a chapter on "the general principles of the chemistry of iron, another on the ores of iron, one on the special properties of iron and its compounds, a chapter on the theory of fluxes, and lastly an exhaustive chapter on fuel, in which the principal kinds of fuel used in the iron manufacture and in steam production are discussed, with remarks on wood, peat, coking of coals, manufacture of charcoal, and analysis of coals."

In Part Second, the practical metallurgy of iron is taken up and exhaustively treated in twelve chapters, in which all the approved processes are fully explained with detailed descriptions of the various furnaces, hot blast ovens, blast machines, etc., now employed in the smelting of iron ores.

Part Third treats of the manufacture of malleable iron, recent improvements in the construction of puddling furnaces, present modes of refining, forging, rolling, reheating furnaces, shearing, piling, etc.; and Part Four is an essay on steel, in which the various kinds of steel and the numerous processes now employed in the steel manufacture are duly discussed, according to their importance.

We find that in this work a common error of authors upon such subjects, has been avoided, and much of the merit of the work consists in the fact that no detail is supposed to be known by the reader, and nothing is jumped, or left to inference. The method adopted is a good one. The author sets out by a sufficiently elaborate discussion of the substances which have to be dealt with in the manufacture of iron and steel, and from the chemical knowledge thus obtained, the reader is led naturally and easily into the practical details of smelting, puddling, and refining iron, and the subsequent operations by which malleable iron is produced.

We have selected the following extract as a fair example of the clear style in which the author writes, and as also giving a good idea of the important part which oxygen plays in the metallurgy of iron.

"OXYGEN.—The air we breathe contains a large amount of oxygen, which plays an important part in the affairs of iron manufacture. It contains a large portion of nitrogen, with which, as metallurgists, we have but little to do, even supposing that steel contains a small amount—into which supposition we may hereafter inquire. It contains a very small portion of carbonic acid gas, a compound of carbon and oxygen, the former of which two elements, also, plays an influential part, determining by its amount, as carbon in iron, whether that iron be cast iron or steel, and, by its absence from iron, that the metal in question is neither cast iron nor steel, but malleable iron.

"Another fact: the atmosphere always contains more or less vapor of water. This water is composed of a large proportion of oxygen, and also a proportion, equal to twice the volume of this last-mentioned element, of another element and gas, hydrogen. The latter element is soon to become better known to the metallurgical world, but it is the oxygen of the vapor of water to which our attention is now called particularly. Here are *four elements*, important in the following order: oxygen, which is the supporter of all combustion, whether as flame or burning coal, and, like that which it supports, a splendid servant, but a labor-exacting master, ever waiting and watching, in its elementary loneliness, to unite with that for which it has affinity, either to help or perplex. Its union with iron forms that which we call the "rust" of iron, in which we see this affinity accomplished, for it has recalled the metal back to its primal state, namely, that of an ore, from which ore, or rust, it was made to become a metal only by the stronger affinity of the same element oxygen for carbon, whereby the act of rusting the carbon was followed by heat enough to expel oxygen from the iron rust in the ore, and leave the metal pure. That rust of carbon is the carbonic acid gas of the chemist. However rapidly in the one case, or slowly in the other, this affinity of oxygen may be exhibited, it is an affinity always in entire subjection to a stronger law of proportion, which it never violates, whether in the long-continued processes of nature, or the more intense and rapid fires and reduction of the furnace. That stronger law is seen in this: oxygen unites with iron in the proportion of only one atom of oxygen to one of iron; or, where a stronger cause exists, and larger affinity is exhibited, it is (never otherwise than as) one and the half of one atom of oxygen to one atom of iron (Ferric Acid excepted). Now, for the sake of brevity, the one-to-one proportion is called the one-oxide, or protoxide, and the other the one-and-a-half oxide; or, using the convenient Latin term, sesquioxide.

"Thus we have only two rusts, or oxides of iron, the protoxide and the sesquioxide. The latter is the highest affinity oxygen ever exhibits for *iron*, whatever higher affinities it may exhibit for other substances or elements. This oxide, therefore, may also be called the "high oxide," or, again resorting to the convenient Latin syllable "per," the peroxide of iron; so that the sesquioxide of iron, in this particular case of iron, is the peroxide, as there is no greater affinity of oxygen for iron known.

"In the case of carbon, however, we know of an affinity of one atom of oxygen to one of carbon; and again two atoms of oxygen to one of carbon. The former is always known as the oxide of carbon, or *carbonic oxide*, and the latter, inasmuch as the gas partakes of such acid properties that it will readily redden litmus paper (the chemist's test for acids) is called carbonic acid, or carbonic acid gas. Carbon is consumable, and oxygen, as we have said, supports combustion; all the conditions, therefore, of flame or fire, exist in carbonic oxide, and it is not remarkable that it is inflammable, and that the combustion should be attended by great heat. But an anomaly does present itself in the case of the other oxide of carbon, wherein the oxygen exists as the *peroxide*, or two-oxide state. We can and need only state this anomaly, namely, that where two parts of oxygen with one of carbon exist, combustion no longer exhibits itself, nor will the gas of this composition allow any combustion to take place wherever its presence exists to any great degree. When, however, from any stronger attraction or affinity, one atom of oxygen is drawn off from the two which go to form carbonic acid gas, and the resultant gas becomes possessed of only half as much oxygen as it previously possessed, the gas immediately becomes inflammable, and burns with great heat. Singular as it may seem, the addition of two atoms of the flame-supporting element, oxygen, to one of the combustible element, carbon, produces a gas which ceases to burn, nor can any combustion take place where its presence is abundant."

STEAM POWER ON CANALS.

In the annual report of the Hon. Van R. Richmond, State Engineer and Surveyor, noticed in our last, we find the following on the use of steam on our canals:

"Attempts have hitherto been made to substitute steam for horse power upon the canal. These have all thus far failed, probably from the fact, that the machinery used was not properly proportioned to the work which it was designed to perform, and that too high a rate of speed was sought to be obtained. The law connecting the resistances offered to bodies moving in water with the power required to overcome such resistances, may be stated as follows:

"The resistance varies as the *square* of the speed and the power exerted varies as the *cube* of the speed; hence, if two horses were sufficient to tow a boat at a speed of two miles an hour, the number required to tow the same at a speed of four miles per hour would be $(2 — \frac{4^3}{2^3} = \frac{2 \times 64}{8})$ 16 horses. It appears, therefore, in order to double the speed, the propelling power must be increased eight times. The obvious effect of the double speed would be to reduce the time of transit one half; this, however, would be secured only at an expenditure for propulsion eight times as great as that due to a speed of two miles per hour.

"The foregoing determinations and comparisons are based upon the assumption that two horses will tow a loaded boat at a speed of two miles per hour upon the canal; as shown by M. D'Anbuisson's formula, 44 per cent more power is required to maintain the same speed in an indefinite fluid. For example, as shown in a former calculation from D'Anbuisson's formula, the traction or resistance encountered upon the Erie canal with the large class of boats, carrying 210 tuns, at a speed of two miles an hour, is 428 pounds, requiring about three horses; then the resistance, at a speed of four miles an hour, would be $(\frac{4^3 \times 428}{2^3})$=3,424 pounds, requiring over 23 horses.

"If steam power should be provided sufficient to obtain an average speed a little in excess of that realized from present horse power, then it might undoubtedly be successfully and economically employed upon our canals.

"A successful application of the principle of low speeds seems to have been made by Mr. Edward Backus, of Rochester. If the result of the several trials made, are correctly stated by the inventor of this novel mode of steam propulsion, then the cost of transportation may be reduced about 32 per cent, as obtained from the following calculation, based upon the same general method employed for determining the cost of horse power. It is stated in the circular of results, by the inventor, that the extra cost of machinery and placing same in the boats is $2,500, and the consumption of fuel from 1,500 to 1,660 pounds of coal in twenty-four hours. Taking the same average for the boats hitherto used, and allowing 20 per cent for the aggregate detentions for the season (the same as now realized), and the following shows the cost of transportation:

Cost of boat and furniture	$5,000
Cost of machinery	2,500
Interest on same	5,250
Repairs of boat and interest on same	2 061
Expense of crew (same on boat with horse power) $185 per month	16,556
Expense of fuel (1,660 lbs. coal per day for 2,263 days) at $7 per tun	13,174
Total expense for ten years	$44,541
Total expense for one day	$19 64
Forty miles averaged per day for the season, per mile	49·1 cents
156 tuns average cargoes for the season, per tun per mile	3·14 mills

showing a saving of 32 per cent over horse power.

"The consumption of fuel, as reported, seems greatly in excess of that required, and can, undoubtedly, be reduced one half when the system shall have been perfected. Should this saving be realized, the cost per tun per mile will then be $2\frac{36}{100}$ mills, a saving of about 50 per cent.

"The following extract from a letter written by Gen. Quimby, U. S. A., who witnessed two trials of this boat, will convey an idea of the character of this new mode of propulsion:

"In this boat the motive power, steam, causes a wheel located near the center of the boat to roll on the bottom of the canal, and thus drive the boat in the same manner that the locomotive is propelled by its driving wheels. The wheel, placed at one end of a lever frame, readily adjusts itself to the varying depths of the water, and its weight, together with the cog-like projections distributed over its circumference, prevents slipping and consequent loss of traction. It has been found that in the whole extent of the Erie canal there are not to exceed twenty miles in which the depth of the water is too great for the wheel to work well. For very deep water, a screw propeller wheel is used and the motive power is changed from the ground wheel to it with the utmost ease and expedition."

Dredging in the Gulf Stream.

Our readers are, perhaps, aware that a scientific examination of the ocean bottom in the Gulf Stream has been in progress under the direction of Professor Agassiz, assisted by M. de Pourtalès. The *Atlantic Monthly* for October has an interesting article upon this subject, from which we collate some particulars of the method employed and the object of this examination.

"Dredging in great depths is a slow and rather tedious process, requiring not only patience but very accurate observation. M. F. de Pourtalès, of the Coast Survey, has been engaged on board the *Bibb* for the last three years in making dredgings in the Gulf of Mexico. These dredgings have included every variety of depth, from the shore outward to soundings of six, seven, and eight hundred fathoms, eight hundred and sixty fathoms being the deepest. They have brought to light the most astonishing variety of tiny beings—especially crowded on rocky bottoms, but not altogether wanting in the deepest mud deposits. A report of the results obtained in his first two years' dredgings has been partially published by M. de Pourtalès in the Bulletin of the Museum of Comparative Zoölogy at Cambridge. They form a most valuable contribution to our knowledge of the animals existing in the deep sea.

"The dredge is a strong net about a yard and a half in length, surrounded by an outer bag of sail-cloth. Both are open at the bottom, but laced above around an oblong frame of iron. This frame has two arms, with a ring at the end of each. One of these arms is securely fastened to the line by which the dredge is let down; but the other, instead of being attached to the line, is simply tied by a weaker cord to the first. This is in order that, in case the dredge should be caught on the bottom, as often happens, one of the arms may give way, allowing it thus to change its position slightly and be more easily freed. It is an important precaution; for sometimes the dredge is caught so fast that it requires not only the force of the small engine to which the reel, holding seventeen hundred fathoms of line, is attached, but the additional strength of all hands on board, to disengage it. When the dredge is lowered—being of course weighted, so as to sink rapidly—a cord is tied around the bottom of the net, while the sail-cloth is left open; thus allowing the free escape of water from the former, while the sail-cloth protects it from injury. When the dredge is lanued on deck, a tub or bucket is placed under it, into which all its contents fall the moment the cord around the bottom of the net is untied. Some-