SECOND PART.

THE PITTSBURG DISPATCH.

PAGES 9 TO 12.

PITTSBURG, SATURDAY, OCTOBER 11, 1890.

PRODUCT OF BRAINS.

Interesting Papers at the Metallurgists' Second Day's Meeting.

HOW GERMANY PROSPERS.

Rapid Strides Made by Her Iron and Steel Manufacturers.

HISTORY OF IRON ORE FORMATION.

Professor Langley on a General Standard of Analysis.

VISITORS LAVISH IN THEIR PRAISE

The final joint international session of the United Metallurgical Senate was brought to a close yesterday in Carnegie Hall.

The hall was fairly well filled when at 10 o'clock Organist Leonard Wales sent a flood of melody through the building by way, as it were, of giving tone to the learned business to follow. Mr. A. Thielen occupied the chair. Sir James Kitson sat on the left, beside him Sir Lowthian Bell, with Mr. Andrew Carnegie in his immediate rear. There were also on the platform, Mr. Daelen, Sir John Alleyne, Mr. Brauns, Mr. Schlink, Mr. Krabler and James M. Swank, of Philadelphia.

Mr. Thielen, upon taking the chair, said he was extremely happy to preside at a meeting of such a learned body of men, representatives of their countries, and after making a number of pleasant remarks introduced Dr. R. W. Raymond to speak on "Prominent German Metallurgists." Dr. Raymond is a bright, earnest speaker and said:

EULOGIZING VON TUNNER.

MR. PRESIDENT—When, nearly 20 years ago, the American Institute of Mining Engineers was founded, one of the first names placed upon its short roll of honorary members was that of Prof. Peter Ritter von Tunner, the founder in 1849 of what is now the world-famous Mining School of Leoben, and the man who more than any other—I might safely say more than all others—made of that school the central seat of the science of the metallurgy of iron. I do not undervalue the distinguished services of Percy in England, Akerman in Sweden, Gruner and Jordan in France and Kerl at Clausthal. I do not forget such names as those of Bell, Karsten and the brilliant Scheerer, too early lost to us. On the contrary, it is upon the support of these eminent authorities that the fame of Tunner securely rests. And if we place to his credit, as we are justified in doing, the splendid work of the institution he founded, and of the pupils he has trained, we may fairly hail him as the Nestor of our profession.

The Iron and Steel Institute and the Verein Deutscher Eisenhuettenleute have set their seals upon this verdict already, by electing Professor von Tunner to honorary membership. He is thus connected with this international assembly by a triple bond of fellowship; and it must be deemed a fortunate and significant coincidence that the day of this session is the first day of the celebration at Leoben of the semi-centennial jubilee of that celebrated institution and of its honored head.

The council of the American Institute of Mining Engineers has delegated to me the honor of proposing that this meeting shall authorize the transmittal to Leoben of a cable message of congratulation. But before I read the proposed message, I beg to say that I could not have assumed this representative function but for the absence of our distinguished past President, Dr. T. Sterry Hunt, perhaps the only man among our American members whose scientific career dates from the same period as that of Professor von Tunner, whose colleague and friend he was at Paris more than a third of a century ago.

PROF. HUNT'S REGRETS.

The following letter was then read by Secretary Raymond. Prof. Hunt is absent from the sessions on account of illness. He is now in Paris:

Dear Dr. Raymond:

The mention of the name of Peter von Tunner, of Leoben, awakens in me many pleasant and tender memories. More than 35 years since, at the great exhibition in Paris in 1855, I was the youngest of a group of jurors, appointed to examine and judge the objects therein, belonging to the domain of geology, mining and metallurgy. It is sufficient to mention among my colleagues the names of Eliede, De Vaux, Warrington W. Smyth and Peter von Tunner. Of that group of jurors, so far as I am aware, von Tunner and myself are the only survivors. How he endeared himself to me and to us all by his assiduity, his earnestness, his sympathy and his profound knowledge of the principles and details of his profession, I still remember with delight.

Again in 1876, having as colleagues our honored fellow-members, Sir Lowthian Bell and the lamented Alexander Holly, whose monumental bronze we have so lately unveiled in New York, I was a judge at our Centennial exhibition at Philadelphia. It was then my good fortune at one of the informal gatherings of our Institute of Mining Engineers to receive as our guest the Ritter von Tunner and to bid him welcome to the institute which he had always honored by his membership. I well remember his pleasant surprise and his emotion at this greeting after 21 years from his former colleague.

And now in the fullness of time are gathered the representatives of three societies, one from Great Britain, one from Germany, and a third, their friendly rival, all devoted to that profession which von Tunner has done so much to render illustrious, and each claiming him as an honorary member. And by a happy coincidence, they meet in the great center of American iron industry on the day when Leoben celebrates the jubilee of its world-famed metallurgical school, and of its founder, Peter von Tunner. What more fitting and that we should send across the sea on this occasion our hearty greetings? I therefore venture to propose a telegraphic message from our international session, conveying our congratulations to von Tunner and to Leoben.

Yours truly,
T. STERRY HUNT.

FRATERNAL GREETINGS SENT.

In accordance with the letter, which was received with a storm of applause, the following cablegram was sent to Prof. Hoefer, Leoben, Austria: "International session of German, British and American engineers and metallurgists sends greeting to Tunner and Leoben."

Sir Lowthian Bell said he had much pleasure in seconding the resolution. "I had the pleasure of making the Professor's acquaintance many years ago," continued Sir Lowthian, "and since that time we have kept up a correspondence. A more affectionate friend I never met in my life. Mr. Frederick Siemens also supported the resolution in a few brief words.

Mr. Gilchrist, in seconding the resolution, said that the name of Gruner would be revered by metallurgists for all time. In his writings were found great truths clearly expressed. Sir William Siemens was one of the most versatile inventors the world has seen. Sidney Gilchrist Mimas, who without having read the writings of Gruner or the blue book of Snetus, in part discovered how steel could be produced on the Bessemer and Siemens from phosphoric pig furnaces, and who, in conjunction with his cousin, Percy C. Gilchrist, worked out the common coal part of the process, aided by many friends such as Edward Martin and others, were worthy of being named in conjunction with him."

PROGRESS OF GERMANS.

Dr. Wedding Treats of the Rapid Strides Made in the Iron and Steel Business Since 1876 — Young Men Handicapped There on Account of the Army.

Dr. Wedding read a paper on the "Progress of German Practice in the Metallurgy of Iron and Steel Since 1876, With Special Reference to the Basic Processes." The paper was a learned treatise of the subject and showed that the doctor was thoroughly familiar with the rapid strides made in the past 14 years. He said:

It is now 14 years since we German ironmasters, in considerable number, visited the United States on the occasion of the Philadelphia Exposition, and found the iron metallurgy of this country, as must be frankly confessed, in an advanced stage of development not previously suspected by us. At that time the United States already occupied, as now, the second rank, with Germany in the third, the product of pig iron for that year being, in Great Britain, 6,550, in this country, 2,093 and Germany, 1,850 kilotons.* This relative position has not been changed. The present annual product of the three countries is, in round numbers: Great Britain, 8,380, the United States, 7,790, and in Germany, 4,530 kilotons. But the proportion of the United States, which was, in 1876, but 15 per cent of the world's product, has now advanced to 30 per cent.

GRATITUDE FOR THE AMERICANS.

When we left America in 1876, it was not only with gratitude for cordial hospitality and for the liberality with which our professional colleagues here had opened to our inspection whatever was worthy of notice in our special field, but also with the conviction that we had collected a great treasure of new and interesting information, which we could utilize for the benefit of our German Fatherland. Particularly the achievements of the never-to-be-forgotten Holly in the field of Bessemer practice, set us an inspiring example for imitation in our own country.

As an expression of our thanks in more practical fashion, I attempt in this paper to sketch what we have done in Germany since that time in the metallurgy of iron and steel, venturing to hope that some portion of what I bring may prove useful to our American brethren.

Germany (including Luxemburg, which is included in the Customs-Union with the empire), produced in 1876 and 1889:

	1876. Kilotons.	1889. Kilotons.
Iron ore	4,712	11,001
Coal and lignite	49,550	84,892
Pig iron	1,846	4,525
Castings	436	940
Malleable iron { ingot iron	249	2,046
Malleable iron { weld iron	943	1,655

I use the words ingot iron (Fluss-eisen) and weld iron (Schweiss-eisen) which are employed by us in official documents and in the Custom House, and the first of which practically comprises all that is called "steel." It is not my purpose to urge again the international harmony of nomenclature which was planned in 1876, but, unfortunately, not completely achieved. I would only remark that we Germans get along very comfortably with the names then proposed, which we adopted at once.

The figures given above may serve to prove that we have taken some pains to maintain our position as the third nation in the competition of the iron-producing world.

Like the United States, and unlike England, France and Belgium, Germany is fortunate in possessing within its own borders the raw materials for its iron industry. There is an importation of ores from Spain, Sweden and Hungary, it is true, but it is not strictly necessary, and, in fact, is more than offset by the exportation of German ores. In other words, we mine considerably more than enough ore for all the iron we make. Since 1876, indeed, the center of gravity of the German iron ore production has moved. It now lies in Lorraine and Luxemburg, on the western edge of the Empire, where 57 per cent of our ore product is mined.

MUST GET ORES FROM SPAIN.

We possess very few ores that are free from phosphorus, and those which we have are so manganiferous that they cannot, generally speaking, be used to make pig-iron for the acid Bessemer process. On the other hand, we have an abundance of phosphoric ores, the greater part being so rich in phosphorus as to be suitable for the manufacture of pig for the basic Bessemer or Thomas process. The remainder is composed of ores of medium tenor in phosphorus, and suited only to the manufacture of forge and foundry irons.

So far as the acid Bessemer practice is still maintained among us, it requires foreign ores; and this need is supplied chiefly from Spain.

The proportion among the different classes of ores in the product mined is about as follows:

Ores which can be used by themselves to make Thomas pig	64.6
Ores suitable for forge and foundry irons	22.2
"Acid Bessemer" ores	2.8
Manganiferous ores (used to make white pig and spiegel	10.4
	100.0

But if we add the foreign ores imported and deduct the domestic ores exported, we have as the proportional consumption of each class in Germany:

Ores for Thomas pig	52.
Ores for forge and foundry irons	22.
Ores for acid Bessemer pig	15.
Ores for spiegel, etc	11.
	100.

But this statement does not correctly represent the actual use of the different classes; for it frequently happens that commercial conditions make it advisable to use, in the production of one kind of pig, ores which would be, of themselves, better adapted to some other kind. (For instance, high and low phosphorous ores are often mixed to produce a forge iron.)

As to our fuels, the figures already given show that we have an abundant supply for all industrial purposes, including, of course, the iron manufacture, for which, with rare exceptions, only bituminous coal and coke made from it are employed. Moreover, our coal fields will not be exhausted in many centuries. Unfortunately, not all our coal basin furnish the material for coke suitable for the blast furnace. Strictly speaking, there is but one basin—the Westphalian or Ruhr coal basin—which satisfies this condition to the satisfaction of the ironmaster. In other districts, as, for instance, that of the Saar, coke is indeed made, but of greatly inferior quality as compared with the Westphalian. In Upper Silesia, the coke made with the greatest pains from domestic coals would seem, nevertheless, to a stranger an utterly impracticable element in the regular conduct of a blast furnace. This difficulty has caused in Germany, perhaps more than any other country, the careful testing of all means of improvement, and the adoption of those which stood the test, in order that the quality of the coke made from poor coal might be made serviceable.

COKE PRODUCTION OF GERMANY.

Dr. Otto estimates the coke production of Germany at 26,313 kilotons, of which 13,401 should be credited to the Ruhr basin, 4,168 to Upper Silesia and 2,092 to the basin of the Saar.

The difficulty with German coking coals is usually to be found, not so much in an excess of ash as in the lack of "coking quality," even when the ash is low. So far as the ash is concerned, an adequate remedy has been found in careful washing after sizing. Our coal washing apparatus leaves little to be desired now that the principle of a preliminary sizing has been fully recognized.

There is a decided advantage of crushing the coal before coking in the more intimate contact of particles thus secured. Experience has shown that the smaller the quantity of heavy hydrocarbons in the coal (these being the well-known determinants of its coking-quality) the closer must the solid particles be brought together in order to form a cohesive coke. To this end many means have been proposed and tried. The attempt has been made, without practical success, to press the coal together in the coke oven. Again, the coal has been made into bricks, which, by reason of their regular shape, could be packed tightly together in the oven; but this practice also has failed of general adoption. Finally, resort has been had to the method of stamping the coal in a box, and charging into the oven the whole of the thick slab thus produced. This procedure has given satisfaction at German works, and is now in somewhat extensive use.

One disadvantage we have in common with the iron masters of the United States—the necessity, namely, as a general rule, of railway transportation over considerable distances for ores or coke, or both. But we lack the magnificent water ways, like the great lakes of the North; and the development of internal canals, as a remedy for this natural disadvantage, is still delayed in Germany.

WELD IRON MUST BE PUDDLED.

To give instances of our transportation of materials: most of the iron ores smelted in Westphalia (where, as already observed, the best coke is made), must be brought from the Siegen district, from the Lahn and from Lorraine. On the other hand, notwithstanding the abundance of iron ore in Lorraine, the iron master there must import not only Westphalian coke, but also (by reason of the sulphury character of the native ores) manganiferous ores from the Lahn as an admixture. And in all this transportation there is no water route except a short piece of the Rhine.

Weld iron (wrought iron) is produced in Germany by puddling exclusively, and almost invariably by that variety of the puddling process (Luftfrischen) which depends upon the air for oxidation. The other variety (Erzfrischen), in which oxidation is effected by means of a fettling ore, and which is so common in America, finds among us a very subordinate application only.

The manufacture of ingot iron in the open hearth furnace is generally conducted in Germany by the Martin process, according to which pig iron is decarbonized by malleable scrap—commonly the crop ends and rejections of the mill's own production. Ore or hammer scale is employed only in small measure, usually as auxiliary to complete the decarbonization. The regular pig-and-ore or Siemens process, if used at all, finds application only in isolated cases and to a very small extent. Equally limited in its introduction has been the practice of blowing air into the metal, used for some time in the Phœnix works at Ruhrort, has since been abandoned because economic advantages for it could not be demonstrated. The process is as frequently acid as basic; the latter method, however, is continually gaining ground, and it is especially interesting to observe that such works in particular as aim only at small output, or have but small quantities of scrap to work up, prefer the basic process. To such extent, indeed, is this true that even in ordinary machine shops and foundries 1-5 to 2 ton open hearths are found in successful operation.

In conclusion I may be permitted to say that the outlook for our German iron and steel industry is neither all brightness nor all shadow. On the one hand, the patent law of 1877 and the tariff law of 1879 have greatly stimulated industrial activity and technical progress in this business, and the Thomas process, coming just at the right time, has made us independent of other countries for our raw material. On the other hand, the severity of military duty, both withdrawing and estranging from labor for three years every strong and healthy workman, and the compulsory contributions required by law from employers for the insurance (life and accident), medical care and pensioning of employes, constitute patriotic and philanthropic burdens, which we must needs feel in competition with other countries not similarly handicapped. But the iron masters of Germany make no complaint. On the contrary, spurred rather than daunted by difficulties, they mean, by increased vigilance, energy, economy, technical skill and continuous scientific researches, to maintain the honorable rank of the German Empire among the iron and steel producing nations of the world.

For the benefit of those who are not familiar with the German standards of weights it may be stated that a kiloton is 1,000,000 kilograms or very nearly 1,000 tons avoirdupois.

Dr. Raymond being called upon to make a reply to Dr. Wedding's paper spoke on the Mannerman process. He said there had already been printed a full statement of his researches which would be at hand for any member.

THE DARBY PROCESS.

Chairman Thielen, of the Phœnix Works, Gives the Results of the Well-Known Manager's Experiments—How Recarburisation is Done by the Method.

Dr. Howe, of Boston, was called to the chair while President A. Thielen read his paper "On the Darby Process of Recarburisation." Mr. Thielen is managing director of the Phœnix Steel Works at Ruhrort, Rhenish Prussia, and one of the best practical students of metallurgy in the world. His paper was as follows:

As is widely known, in order to produce in the converter, by means of Sir Henry Bessemer's great invention, steel of a wished-for percentage of carbon two methods present themselves. By the one the process is stopped when the bath possesses the desired contents of carbon; by the other the bath is completely decarburised, and then the wished for carbon added in the form of spiegel, ferro-manganese, etc. In Germany the latter method only came into use and was retained when the Thomas-Gilchrist process for the production of steel, low in phosphorus, from highly phosphoric iron in the basic converter came successfully into use.

DECARBURISATION IS NECESSARY.

The more so as from the nature of the process, before dephosphorisation takes place, complete decarburisation is necessary. But while, by the old acid process the carburisation readily takes place by the simple addition of spiegeleisen etc., the new process brought with it difficulties, not easy to overcome, inasmuch as the oxides which are always present in the basic process to a larger or smaller extent, and also the phosphoric acid of the slag takes part in the reaction. Even if one succeeded in removing part of the oxide by pouring off the slag and regulating the amount left dissolved in the bath by so perfecting the process, that there would be approximately an equal amount remaining in each charge, and even if the danger of rephosphorisation were diminished by as complete a removal of the slag as possible and by suitable slag additions made to the still remaining slag, still the production of low phosphorus steel high in carbon could not be accomplished so readily as not to make the introduction of another simple method of carburising well worth wishing for. The circumstances are similar as regards the basic and acid open hearth processes.

It can be readily understood, therefore, why, after the introduction of the method of making steel in basic-lined vessels, proposals which have been formerly made for the introduction of carbon other than by the indirect way, by means of spiegel, etc., but which had hitherto remained without results, should be brought forward again from various quarters. All of these processes were based on the known fact of the great affinity between carbon and iron at high heats. It was sought to reduce and carburize the bath of steel by the introduction of carburetted gases, by the addition of tar, petroleum, etc., as well as many mixtures of these substances with solid bodies, such as burnt dolomite. However, the results of all these experiments did not lead to the permanent introduction of any of them in practical work, until Mr. John Henry Darby, the Managing Director of the Brymbo Steel Works, succeeded in finding a solution of the problem.

Having attentively remarked an increase of carbon which took place in two pieces which had been treated in the coal fire for welding, he brought fluid steel into intimate contact with solid carbon, the result being a rapid absorption of the carbon by the steel. Supported by this experiment he founded on it his patented process by which fluid steel can be carburised by filtration through pieces of carbon, preferably in the form of graphite or wood charcoal, etc. This consists of a sheet-iron cylinder open at the top and closed at the bottom by a plate pierced with numerous holes, the whole being lined with refractory material. It is filled with the carbonaceous material and inserted either between two steel ladles or between the Siemens furnace and the steel ladle. The fluid steel takes its way through the interstices of the pieces of carbon, and is thereby brought by absorption of the carbon, to the wished for percentage of carbon.

HOW DARBY EXPERIMENTED.

Mr. Darby's experiments extended wholly to the carburising of open-hearth steel, and be succeeded by his process in conjunction with the basic process in producing from phosphoric raw material a very excellent product, which with any wished for percentage of carbon to upwards of 0.9 per cent contains only very small traces of other bodies, and consequently is distinguished from all hitherto known open-hearth steel by its exceeding toughness. It has been worked up into chisels, knives, wire, etc., with the best results. And there was a very great certainty in obtaining the right percentage of carbon, the percentage obtained varying from that wished for seldom more than 0.01 per cent to 0.02 per cent. The rolling quality of the material, although only very small additions of ferro-manganese or ferro-silicon were made, was very good. The process was very soon exclusively employed at Brymbo, for the harder steels, but in order to introduce his system to the Bessemer process, Mr. Darby entered into an agreement with the Phœnix Company of Laar near Ruhrort on the Rhine. The experiments were arranged in the Basic Bessemer works. The carburising vessel was arranged between two ladles standing one over the other and the steel carburised while streaming from the first into the second ladle by the stream of carbonaceous material issuing, regulated by the valve handle. It quickly appeared, however, that the basic Bessemer steel, although readily carburised, yet thereby lost its rolling qualities to such an extent that the ingots fell to pieces in the rolls. On inquiring into the cause of this it was discovered to be due to the method of carrying out the process, viz: that for four minutes, more than 60 fine streams of steel were oxidized, by means of the atmospheric oxygen. It was sought to overcome this drawback by replacing the 60 holes in the bottom of the vessel by one of suitable diameter. A considerable improvement in the rolling quality of the ingots was thereby produced. But the rolling quality attained was not equal to that of the ordinary Thomas ingots.

SOME PRETTY LARGE INGOTS.

The carburising vessel was replaced by a refractory lined funnel, open at the bottom, which was arranged between the casting ladle and the molds. By an arrangement attached to the side of the casting crane it was possible to introduce into the funnel the ground carbonaceous material little by little in a well regulated stream. This arrangement consists of an accurately bored cylinder, provided with a lathe-cut worm. As is readily apparent the amount of carbonaceous material forced out, is proportional to the number of rotations which the endless screw makes, which can be accurately regulated. By the employment of this apparatus the carburising is safely done in the wished for manner and good rolling ingots obtained. The ground coke appeared to be more quickly absorbed than the graphite, so that the whole of the experiments were carried out with this material. It was found that with ingots weighing 1,400 kilos and measuring 16 inches square, the carbon was very equally distributed throughout. By some attention the frequently occurring increase of carbon in the top parts of ingots of this weight was successfully overcome by a lessened addition of carbon in the upper part. In order to test the equal distribution of the carbon, ingots were rolled down into 2-inch billets and tests taken from the two ends and the middle of the same.

In the basic Bessemer (Thomas) process: the carburising takes place in the almost complete absence of the slag, rich in oxides and phosphoric acid, consequently it proceeds with certainty, it is accompanied by no important rephosphorization, and is practicable for any desired percentage, without simultaneously increasing the manganese. By the omission of the spiegeleisen a considerable economy is effected.

ECONOMIZED BY SAVING SPIEGEL.

In the Bessemer process: the carburisation takes place up to the highest grade of hardness with far greater safety than by the help of spiegel, and without the increase in manganese, consequent upon the employment of the latter process. Here also a considerable economy is effected due to the saving in spiegel. The trials were made among others on some American works.

In the open hearth process: for the acid and basic open hearth processes, the advantages obtained are very nearly identical with those mentioned for the Bessemer and Thomas processes, the very considerable cost of the ferro-manganese and ferro-silicon especially, wholly or for the greater part avoided. The combination of the process with the basic open hearth process permits of the production of a steel, which for many industrial purposes can successfully measure itself with crucible steel. By this method also a material is produced, which in the future will find very advantageous employment as the raw material in the crucible steel process.

The economy resulting from the employment of the carburising process is here considerable; a similar relation holds good in the acid open-hearth process. From the foregoing it is clear that the superiority of the carburising process in regard to the question of cost becomes the more considerable the higher the grade of hardness of the material to be produced; to the advantage that the harder sorts of steel can be produced with far greater ease and safety. There is to be added the very considerable economy in the cost of production, while by the old process the cost of production rose considerably with the grade of hardness.

During the month of July there was effected in the carburising process another modification, which considerably improved one of our leading articles, viz. tyres. We use for the manufacture of tyres small ingots containing sufficient material for one tyre, which after being hammered into flat disks are perforated in the middle, this perforation being enlarged before the disk is reheated before rolling. This method requires that the surface of the ingots is without any flaws, and it must be as well without any pores, as all deficiencies can be seen afterward in the finished type. The Siemens Martin steel obtained by the carburisation process does not show immediately after the casting an absolute even surface. The carburized material was therefore taken as material for tyres.

ALUMINUM IN THE BATH.

Experiments were made to give the bath a small addition of aluminum and in consequence of this all difficulties were removed. By adding at the outside 0.04 per cent of aluminum an ingot was obtained, which was absolutely free from porosities; and eminently fit to be used for tyres. Following up these experiments several solid castings were made out of the carburized material and these turned out equally satisfactory, being positively flawless.

Mr. P. C. Gilchrist opened the discussion of Mr. Theilen's paper. He said:

I can freely indorse his process. When Mr. Darly mentioned his process I followed it step by step with much interest. You are aware that there were two discoveries required to perfect it or two in the case of open hearth and three in the case of basic. In July of this year Mr. Arthur Coop, of the Northeast Company's Works, went over with me to Ruhrort and saw everything in connection with basic open hearth and basic Bessemer. We found, ourselves, everything Mr. Thielen has stated in his paper. Our experience differs from the German experience. Mr. Cooper says in his letter:

"In accordance with my promise I hand you on fly leaf the estimations of carbon in each of the nine ingots of blow 370 and in each of the eight ingots of blow 378, together with the phosphorus and several manganese results. I also hand you the mechanical tests of rails made from the above blows, which you will see give exceedingly regular results. The amount of carbon arrived at in blow 370 was 45 to 50, and in blow 378, 30 to 35."

Mr. Snelus said we were now able to make a steel equal to any made from the best Swedish iron. He paid tribute to Mr. Thielen for the diligent and thoughtful manner in which the tests had been carried on, and perfectly agreed with him in everything he said in his paper.

Mr. Thielen (smiling)—I am happy to hear that all you gentlemen thoroughly agree with me, and I perfectly agree with myself.

STANDARDS FOR ANALYSIS.

Prof. Langley, Formerly of This City, Tells of the Work of the American Committee—Important Discussions Pertaining to Double Chloride Solutions.

Prof. John W. Langley read an interesting compilation of facts and figures on the "International Standards for the Analysis of Iron and Steel. His paper was as follows:

In the summer of 1888 it was the fortune of the writer to present the subject of the desirability of establishing a set of samples of steel, which should be analyzed with extreme care, in order that they might become standards to which scientific and commercial analyses of iron and steel could be subsequently referred. Also, that greater uniformity in the results of analyses might be brought about, since these standards would bear toward analytical methods somewhat the position which the original units of weight and length, the gramme and meter, or the pound and yard, preserved in Paris, London, and Washington, do to the mechanical arts.

An ingot of tool steel, 3¼ inches square, poured from a single crucible, in which the metal had been thoroughly "dead melted," was heated and hammered barely enough to round off the corners. The ingot was then cut into two pieces, one of which was then reheated and hammered down to a bar 1¾x3¾ inches.

PITTSBURG MATERIAL WAS USED.

The other half of the ingot was turned in a lathe with a blunt tool, exactly as in the manufacture of the international standards, and the turnings, after sifting from fine dust, were thoroughly mixed and then sealed up in glass jars. The hammered bar was drilled and the drillings similarly treated. This material was given by the Crescent Steel Company, of Pittsburg. The object of this was to have two bodies of metal presumably identical in original composition, but one of which had received a large amount of mechanical work, the other approximately none. These samples are designated exp. standard, ingot, exp. standard, hammered, respectively.

The apparatus used by Dudley consisted of an ordinary Bunsen furnace with 15 burners, in which was a porcelain combustion tube five-eighths of an inch internal diameter, and 18 inches long. Inside this tube, about three inches from the end toward the absorption apparatus, was granulated and porous oxide of copper, occupying about four inches of the length of the tube, and filling the bore. This was held in place by asbestos plugs at either end. Next to the oxide of copper, toward the boat, was placed a roll of metallic silver about 4 inches long, nearly filling the bore of the tube. Rubber corks were used at each end. The combustions were all made in oxygen gas, using air to finish the aspiration and clean out the tube. The oxygen gas used was obtained in the market in cylinders, the gas being compressed to 250 pounds per square inch. Between the oxygen holder and the combustion tube was placed first a copper tube, about 4 feet long and ¼ inch in diameter, fitted with three coils at the middle; next a potash bulb, and after that a chloride of calcium tube.

HOW THE OXYGEN GAS WAS USED.

All the oxygen gas, and the air used in the combustions, was passed through these parts. The copper coils were kept red hot by a Bunsen burner during the passage of the gases, the idea being to burn any possible traces of combustible in the gas or air before they should go into the combustion tube. Between the absorption end of the combustion tube and the potash bulbs were, first, a washing tube containing about 5 cc. of sulphate of silver solution, with perhaps ½ a gram. of silver sulphate, and next, a chloride of calcium tube.

The potash bulbs were of the Geissler order, of small size, made to order. These were fitted with a small chloride of calcium tube containing chloride of calcium simply, and commonly called the prolong. The whole absorption apparatus weighed, when charged, about 60 grams. The absorbing solution in the bulbs was the ordinary caustic potash solution recommended by Fresenius. The absorption apparatus was protected against the aspirator bottle by a full size chloride of calcium tube. The joints were made with ordinary rubber tubing. The carbon from the steel was caught on an asbestos filter in a platinum boat, and dried after very complete washing. The boat with its filter and carbon was put into the tubes without transfer. During combustions a slight pressure above the atmosphere was always maintained in the

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With the New Industries Which Will Be Established Thereby.

SUGAR AND THE FREE LIST FEATURES

WASHINGTON, October 10.—Among the campaign documents which the Republican Congressional Committee has issued for this campaign, one which has just appeared affords a complete analysis of the McKinley bill. It explains the plan embodied in the McKinley bill, showing the method and purpose of its construction and pointing out the conditions that have prompted each and every increased duty. In the law which has now been placed upon the statute books these features are paramount:

First—The internal taxes on tobacco have been materially reduced, on the theory that all direct taxation should be brought down to the lowest possible figure.

Second—The free list has been enormously increased by the addition of practically every article known to our commerce that is not or cannot be profitably produced in this country, on the theory that the proper subjects of importation into a well-ordered country are not those articles that its people can supply to themselves, but those that they cannot supply, and that goods of this character should be brought to the consumer at the cheapest possible price.

Third—The dutiable list has been thoroughly revised so that: (a) The revenues necessary to carry on the Government shall be so collected as largely as possible from foreigners in return for the privilege of selling their goods in our markets; (b) Foreign competition—which means a competition in cheap labor, a competition in flesh and blood—shall be checked wherever it threatens to lower the American standard of wages and to drive American producers out of business; (c) Numerous branches of industry never heretofore carried on in America shall be encouraged to undertake production, thus increasing the opportunities for the profitable investment of capital and profitable occupation of labor; (d) The cost of necessary supplies to the American consumer shall in no case be raised, but shall in response to the law of free domestic competition go on decreasing in the future as it always has under the protective policy in the past.

THE LARGE FREE LIST.

An Explanation of That Feature of the New Law.

The Republican party has enacted the McKinley bill after ten months of profound investigation and elaborate debate. It undertakes to say that a wiser, braver, fairer revenue bill has never been provided in all the history of the Republic! It undertakes to say that under the operation of this new tariff the American people will pay a smaller proportion of the expenses of the Government than ever before. The conclusion will be forced upon any fair-minded man who takes the trouble to examine its provisions. In the first place, a large portion of the internal revenue taxation on tobacco has been remitted, and all those annoying special licenses for the sale of tobacco have been abolished. The American farmer and retailer are as free to-day to sell their tobacco as their wheat.

In the next place, practically all direct taxation, except the internal revenue taxes on whisky and tobacco, have been remitted to the people. This has been done by means of a remarkable enlargement of the free list. It is practically true to say that everything the like of which is not or cannot be largely produced in this country has been placed on the free list. A duty on this class of articles is a revenue duty and is paid by the consumer. In this respect it differs entirely from a protective duty, which is often wholly and always largely paid by the importer. By its additions to the free list, then, the Republican party has left in the people's pockets a sum which last year amounted to more than $65,000,000, and has opened our ports to merchandise—upon which the American consumer has heretofore been paying a tax—which was last year imported to the value of $365,406,000. This is nearly 50 per cent of the total importation, and is 10 per cent greater than the face importation provided in the Mills bill. When it is considered that among the foreign products transferred by the Republican party from the dutiable list to the free list are such universally used articles as sugar, molasses, needles, dried currants, round or split straw matting, sisal grass and manilla for use in the manufacture of binding twine; braids, seeds, hemp, turpentine and jute, the importance of this legislation may be appreciated.

THE CHANGE ON SUGAR.

It is Expected it Will Cost Two Cents Less a Pound.

For the reduction of the revenues the Mills bill relied chiefly on free wool, the McKinley bill on free sugar. This circumstance admirably illustrates the difference in spirit and purpose between the two measures. We consume 600,000,000 pounds of wool annually and we can produce the whole of it. We do not need to go abroad for a single fiber. We consume 1,423,000 tons of sugar, and we can produce only 226,000 tons, not 20 per cent of our demand. Now, the Republican policy is to protect wool, which we can and do produce, so as to hold our market for our own producers, and to encourage wool growing and wool manufacturing; and, on the other hand, freely admit sugar, which we are not largely producing, so as to put it into the coffee cups of our own people at the lowest possible price. The Democratic policy is to admit wool free, thus drawing the semi-savage wool growers of Asia and South America into competition with our farmers, to the inevitable destruction of our wool industry, and to tax sugar. The Republican policy proposes to send no more money out of the country than is absolutely necessary.

The Democratic policy proposes to send out as much as possible, and needlessly to tax the American consumer as well. With wool on the free list every advantage is handed over to the foreign producer, and with a duty on sugar every hardship is imposed upon the American consumer. With wool protected every advantage is held for the American producer, and with sugar free every advantage is left to the American consumer.

INCREASED DUTIES.

A List of the Articles Upon Which They Have Been Placed.

Now, as to the goods that remain on the dutiable list, the Republican party undertakes to say:

First—That the effect of its changes in rates will be in no case to increase the cost to the American consumer of a single article which can with any propriety be called a necessary household expense.

Second—That so far as increased cost to retail buyers is concerned, the people will never know that a tariff bill has been passed.

Third—That all this Democratic talk about "increased taxation to the people" is nothing but downright falsehood.

Fourth—That the consumer will appreciate the existence of a new tariff law only by its results in the reduction of his necessary household expenses.

Undoubtedly many rates have been raised, many remain as they were, many have been lowered. But the claims just made are established by the fact that every increased rate must be placed in one of these five classes:

First—That which consists in the correction of errors. This is a small class, rendered necessary by the inequality in rates between the raw material and the manufactured article, or by Treasury Department regulations, or by a failure in the language of previous acts to express the Congressional will clearly and accurately. The interests of the consumer are affected by this class, if at all, only in an infinitesimal degree.

Second—That which consists in the revision of ad valorem rates where, by reason of the great fall in prices, they have lost their protective value. This is also a small class. It has resulted largely from new and improved machinery and from the great fall in transportation prices, so that the moderate ad valorem levied in former tariffs no longer possesses any protective strength, but signifies less by from 30 to 75 per cent than it signified when originally levied.

Third—Agricultural products. An important and general increase in duties has been provided for all farm products. The tariff of 1883 has been found by experience wholly inadequate for the protection of the farmer. Although, under the protective system, his expenses for necessary supplies, such as farm implements, hardware, clothing, drygoods and groceries has been constantly decreasing, he has been unable to obtain for his own products a fair living price. Importations of farm products into the United States have increased from $40,000,000 in 1850 to $256,000,000 in 1889. The purpose of the McKinley bill is to check this importation, and to hold the American market for the American farmer.

Fourth—Luxuries, whether their like is produced here or not. Champagnes, brandies and cigars are illustrations of this class. The theory upon which these articles are made to pay a heavy duty is conceded to be correct, even by the advocates of a "revenue tariff." It insists that people who can afford such indulgences can afford to contribute through them to the support of the Government.

Fifth—That class of fine manufactured goods hitherto not produced in this country. The American market for these goods has hitherto been conceded to foreigners. They constitute the largest and by far the most important of these five classes. They include such articles as fine laces, fine linens, the finest grades of woolen goods, of satins and velvets, and the most highly decorated pottery. The want of protection is the only thing that has stood in the way of the manufacture of these goods in America. Into their manufacture the elements of human labor enters enormously, and it is the Republican party's proposition, by imposing such a tariff on the foreign article as will make up for the difference between the price of labor here and the price of labor abroad, to enable our people to enter into this new kind of manufacture.

NEW INDUSTRIES EXPECTED.

A Special Reference Made to the Duty on Tin Plate.

This classification of the increased duties throws a bright light on the motives which have prompted the current lies about the bill. It is plain that the bill can be profitably attached only as to this final class of higher tariffs, and as to that class only, by representing that the people will have to pay higher prices for their supplies now than formerly. Here, then, is where the attack is being made, and it has taken the nature of an artful mixing up of the varieties of goods sold in our market, making the higher tariffs apply to them all indiscriminately, whereas they only apply to those of which the manufacture for our market has hitherto been conceded to foreigners. As to these, two things are to be said: First, that in a majority of cases the foreigners are now charging us exorbitant prices; and the new tariff will operate only to maintain these prices until our own people can get to work manufacturing; and, second, that all other cases relate to luxuries, to parlor ornaments, the highest class of dress goods, etc., upon which wealthy people can afford to pay higher rates until domestic competition has had its inevitable result.

The tin schedules will illustrate these points. We are now buying all our tin plate from England. Last year she sold us 742,136,640 pounds of tin plate, and it cost us $21,726,707. In the last 25 years we have sent over to England the tremendous sum of $320,037,362 for tin plate, every penny of which might, as well as not, have been kept here in the employment of our own people. We can make our own tin plate just as well as England, if the price can be kept where it is to-day. The English plate is made in Wales, where cheap female labor, costing from 30 to 65 cents a day, is employed. On the basis of their net cost, the English are charging us 300 per cent profit on this plate. A common tin cup, for instance, that retails all over the United States for five cents, cost the Welsh manufacturer only about one and one-third cents. The dinner pail in which the American laborer carries his roll and his coffee, costs the greedy Briton less than 12.

FORMED A COMPANY.

The Typewriting Telegraph Machine Will Probably be a Go Now—Pittsburg, New York and Western Capital in It—It Will Revolutionize Telegraphy.

What promises to be a revolution in telegraphy is about to be formally launched among public affairs by a company of men well known as specialists in the advanced science of printing and thought transmission. New York shall have the honor of being the head center of the business transactions of this new enterprise, as there is where the inventor of the device has his residence.

When H. H. Byram, the late well known editor, was alive one of his pet schemes was the Wright invention of type-telegraphy, its great possibilities and how in the future an operator in Chicago could on one of these new machines telegraph a message to New York, and at the same time write out a type-written reproduction of the message. All of this work is to be done by one man. Then, it will be seen that if this new system is practicable, one sender, who has control of the typewriting device at the other end of the line, can send, and at the same time cause to be accurately and truthfully written, the message he desires to transmit; the only necessary person being some one to fix the sheets of paper about to be printed upon by the types. A mistake, it is claimed, cannot be made, because a letter will not respond to any motion, except the one that will be controlled for it.

A company has been formed with a capital stock of $1,000,000. The stockholders who own the controlling interest in this enterprize are Joseph G. Siebeneck, Robert H. Camp and John E. Wright, the inventor and patentee, of New York City. In addition to them there are W. H. Smith who is president of the company and others with him living in Chicago, together with business men residing in Cleveland, New York and New Jersey. The company is to be chartered under the laws of the last named State. The Pennsylvania and New York corporation laws were thought to be far to expensive and so New Jersey must be tee home in law of the enterprise.

A HYPNOTIC SÉANCE AND WHAT CAME OF IT

CHAPTER I.

THE RIVALS.

John Kennedy was the very best fellow in the world, and so, when one day last week Robert Malton came up to him as he was standing outside the Grand Hotel, Paris, and said, "Look here, old fellow, I am very sorry that we have quarreled, and I should like to make it up with you," he was only too glad to put out his hand, give a hearty grasp, and say, "Why, we never really quarreled, old chap—at least I didn't—so there is no need to make anything up. I am heartily glad to see you. Won't you come and dine with me at the Anglais?"

John Kennedy was engaged to be married to a very beautiful girl in the North of England, a piece of great good fortune for him, for Mabel Sheppard was not only, as has been said, a lady of great personal charms, but enjoyed in her own right a fortune which, even in these opulent days, may be accounted as considerable. Such a parti, of course, had been very much run after, and it was not without having to combat innumerable rivals that Kennedy had succeeded in his courtship. Among the most fervent admirers of the young lady had been Robert Malton, who has just been introduced; and at one time it had really seemed that the beautiful Mabel and her thousands would become his.

Since the announcement of the engagement had been made there had been rather a scene between the two rivals.

"Why should you come and take her away from me?" cried Malton. "You are as rich as she is. You could have afforded to marry a girl without a penny."

Kennedy had answered: "I never thought anything about Miss Sheppard's money, but it is certainly no objection to a wife that she has fortune."

Rather high words had followed, and the two men had separated to meet again, as has been described, by chance outside the Grand Hotel.

Half an hour later, as they were sitting over their dinner in a private room of the Cafe Anglais, Malton said: "I had nothing to do this morning, and so I went with a medical friend to the Charite Hospital, and heard Dr. Luis delivering his lecture on hypnotism—the queerest lecture I ever heard."

"Oh, hypnotism," cried Kennedy; "everybody in London is talking about it. I am very much interested in it. Do you believe everything that is said about it?"

"I can't form an opinion, as I have not seen any of the experiments. I should say that it is the same thing as mesmerism; and yet one does read such curious accounts."

"I say, Malton, you would oblige me awfully by taking me to the Charite—I should so like to hear one of those lectures. As I have told you, everybody in London talks about it; it is the topic of the hour, and I feel quite foolish having to sit by and being unable to express any opinion at all. Can you take me to the Charite?"

Malton looked up quickly and suddenly; a wicked gleam came into his sharp little eyes, as if an infernal thought had struck him. After a pause he said: "I do not know, old fellow. You know I would like to oblige you—I would do anything that I could for you—but I am not sure about being able to arrange this for you. Both Luis and Charcot very much object to having strangers—that is to say, people who are not students—at their lectures; and I only got in by borrowing a card of a friend of mine, so that I passed as a medical student. But I'll tell you what I can do for you; the friend I am telling you about is one of Dr. Luis' best pupils, and can perform exactly the same experiments as the professor himself. If you would like to have a private hypnotic seance at your room, or anywhere that you like, I will get him to come and to bring a couple of subjects with him. He will be only too glad to oblige you. Besides, you will be able to talk to him and ask him all the questions you want; and that, of course, you would not be able to do at the Charite."

"Why, it's a capital idea," said Kennedy. "I am very much obliged to you. When do you think you can get him to come? I am free any evening. Look here, suppose you ask him to come and have dinner with me at the Grand Hotel. After dinner we can go upstairs; he will give me a lecture, and, of course, if there is anything in the way of honorarium I shall be only too delighted.

CHAPTER II.

THE SEANCE.

The next evening, at 7 o'clock, Malton arrived at the Grand Hotel, accompanied by a tall young man whom he introduced to Kennedy as Dr. Bernard. This gentleman, as it transpired, spoke English very well, so that he was able to converse with his host all through the dinner. He made a very good impression.

"I feel quite ashamed to talk to him," whispered Kennedy to Malton—"I feel so ignorant by his side."

Malton nodded assent, and turned away his head to hide a smile.

"Oh," said Malton, "I forgot to tell you that Dr. Bernhard has not been able to bring any subjects with him, but he says that he can experiment with anybody who likes to volunteer."

"But have you power over everybody?" said Kennedy, rather incredulously.

"Almost everybody is susceptible to the influence," said the doctor.

Shortly afterward the party went upstairs to the apartments which Mr. Kennedy occupied on the second floor of the hotel. The drawing room was lighted and arranged for the reception, and by 10 o'clock all the guests had arrived.

"Now," said Bernhard, "for the experimental part of my lecture. Who likes to offer himself?"

There was a pause. Nobody seemed inclined to come forward until Kennedy, springing up from his seat, said, "I must give an example; do with me as you like."

Bernhard looked at him. "Make up your mind to obey me," he said, "or else the experiment may fail. The more I look at you, however, the more I am convinced that you are not an obstinate man. Sit down in that chair, please—so! Now close your eyes and go to sleep."

Kennedy looked up, glanced around the room with a smile on his face, then brought his eyes back to those of the operator, closed them and sank back into his chair.

"It is no more difficult than that," said the doctor, looking around.

"Do you mean to say that he is asleep?" cried a lady at one end of the room, in a tone of unbelief.

"Certainly, he is."

"I don't believe it," cried several people in a chorus.

"Well, then, you will see."

Addressing the patient, he said: "You hear me, don't you?"

"Oh, yes," said Kennedy; "I hear you very well."

"Do you know what is the matter with you?"

"No; won't you tell me?"

"You have got a very nasty taste in your mouth—that cigar you smoked after dinner was a bad one; that taste has been bothering you for the last ten minutes, and you don't know how to get rid of it. I will tell you what to do. Go to that little round table by the fireplace; you will find a basket on it full of peppermint lozenges. Take one and suck it."

The patient obeyed. He rose from his chair, walked across the room, went up to the little card table on which a basketfull of ivory counters were lying, took one, put it in his mouth and began sucking it with an expression of very great pleasure.

"Isn't that nice, now?" said Bernhard.

"Yes," said Kennedy. "But it is rather too strong—too much peppermint in it."

"Come here," said Bernhard. "Open your mouth—why, you miserable fellow, what have you been doing? What do you think you have got in your mouth?"

"A peppermint lozenge," said Kennedy.

"No, no! it's nothing of the sort!—it's a red-hot coal; don't you see that it's burning your mouth—spit it out, spit it out before your tongue is burnt off!"

There could be no doubt whatever of the illusion under which the patient was laboring, for immediately the operator spoke of the burning coal, Kennedy's face, which until then had worn a placid expression of pleasure, became contorted as if with violent pain. Everybody agreed that it would be impossible for a man to simulate such an expression, even if he had been the cleverest actor on the face of the earth. He spat the ivory counter far from him, and ran moaning round the room, holding his hand to his tongue.

"It hurts you—does it not?" cried Bernhard.

"Oh, fearfully!" replied the patient with a moan.

"I will tell you what to do," continued the doctor; "you can get rid of your pain at once if you will obey me. There is the fireplace, and under the grate there is a great heap of snow; take some, put it on your tongue, and your pain will disappear at once."

Kennedy darted across the room, stooped down to the grate, caught up a handful of ashes, and was about to carry them to his mouth when the operator, reflecting, cried out, "Oh, never mind—the fact that you had the snow in your hand will be enough. The pain has gone, has it not?"

As he spoke the patient's face resumed an expression of intense relief.

"Yes," he said, "I don't feel any more pain."

"I think that is enough," said Bernhard. "I should like to go on with him, for he is one of the best subjects I have ever seen—but there, I must not abuse."

"Now then"—addressing the patient—"wake up."

"What have I been doing?" said Kennedy a minute afterward, looking round. "You don't mean to say that I have been hypnotized."

"Oh, you have," cried several ladies; "you have done the most extraordinary things; I could never have believed it possible."

"But I feel nothing," said Kennedy; "all I recollect is a vague feeling of drowsiness."

CHAPTER III.

THE CRIME.

"Who will be the second subject?" said Bernhard.

"I will," said Malton, springing up. "And there is one thing, Bernhard, I should like you to try and force me to do, because I don't believe that any patient, however he may succumb to the influence, can so far lose his consciousness of what is right and wrong as to commit a crime."

"Oh," said Bernhard, "in about nine cases out of ten the patient, after a struggle, obeys."

"Well," cried Malton, "I defy you to make me commit a crime while I am in the hypnotic state."

"Very well," said Bernhard.

It took more time to send Malton off than it had done with Kennedy; but after awhile he succumbed, and, remaining in the cataleptic state, awaited the commands of the operator.

Bernard then caught up a newspaper, twisted it up into a roll, and handed it to Malton, saying,