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Contents:

(Illustrated articles are marked with an asterisk.)

THE AVONDALE COLLIERY DISASTER.

On the 6th inst. the telegraph wires transmitted news throughout the land that appalled every heart; one hundred and ten men, the dispatch informs us, were buried in a mine at Avondale, Pa., the only source of egress from which was cut off by a merciless conflagration, and there was little, if any hope that a single man would be rescued.

The worst fears have been realized; the bodies of the miners have been found huddled together smothered, after making such futile efforts as lay in their power to isolate themselves from the poisonous gases which filled the mine.

The heart-rending details of this sad catastrophe have been given to the public through the daily press, and we will not dwell upon them. Liberal donations have been made for the relief of the bereaved families of the miners with a hearty promptness which speaks volumes for the philanthropy of the country.

It is due to the Delaware, Lackawana, and Western Railroad Company to say that its action since the occurrence of the accident has been all that ought to have been expected. We are sorry to say that we do not think the disaster need have occurred, and that it might have been prevented at a less expense than the company has incurred in its efforts to soften the blow to the afflicted survivors. Common-sense and humanity would seem to demand that men exposed to the perils of coal mining should not be forced to depend upon a single narrow avenue of escape, liable to be cut off at any moment by an accident of this kind.

It is evident that the method in which coal mining is conducted is behind the age. Gigantic enterprises in engineering are conducted to brilliant success in other departments, and yet year after year coal miners are forced to go down to suffocate beyond the reach of help, or to be suddenly struck down by some fatal explosion.

We are glad to see that the subject of averting these calamities is claiming the earnest attention of scientific investigators and engineers in England, and the heart-rending disaster at Avondale will not be an unmixed calamity if the lesson it teaches be generally heeded in this country. Our European exchanges inform us that Mr. H. Bessemer, the well-known improver of the manufacture of iron, has suggested a remedy which seems likely to avert explosions. Gas in incased burners having combustion supported by compressed air will give a very bright light for a long distance; and by these lamps being placed at intervals in the mine, the use of the "Davy" can be dispensed with. The gas is fed from the ground above the mine, and the great air pressure within the lamp will force out the products of combustion, so that the gases in the mine will not be able to enter and explode. In the talked-of tubular tunnel to connect England and France this idea might also be utilized. All that compressed air can do is as yet uncertain; for if it be without and within a man simultaneously, life is supportable, and the brightest light beneath the waters in diving explorations or the laying of submarine foundations is ever desirable.

One thing should however be insisted upon, that a single avenue of entrance and exit to a coal mine shall no longer be deemed sufficient, and the miners will be sustained by the public press in demanding that more ample means of escape be provided.

A method for preventing explosions in mines, having their origin in blasting, will be found in another column, with an engraving illustrating the apparatus employed.

THE ADJUSTMENT OF HOT-AIR FURNACES.

We are in receipt of our annual crop of inquiries in regard to the proper adjustment of hot-air furnaces, which we will attempt to answer as briefly, yet comprehensively as possible.

The apparatus for heating buildings with hot air may be divided into seven parts; namely, the fire-box and flues in which combustion is performed; the chamber through which the air passes to be heated; the cold air pipes leading to this chamber; the hot air pipes leading from it to the registers; the registers which admit the air to or close it off from the apartments to be heated; the external registers or openings which admit the cold air; and, lastly, the registers by which the exhausted air is permitted to escape from the apartments to make way for the warmed fresh air which enters. We have here a complicated apparatus, each part of which is essential to the perfect working of the whole; and the wrong adjustment of any may defeat the end sought; namely, to heat and ventilate equally and perfectly all the apartments connected with the apparatus.

The fire box should be cast very thick and heavy, the better to guard against sudden fluctuations of temperature caused by neglect in firing, or an overcharge of coal. The grate should be sufficiently open to admit of a good draft, and the dampers should fit accurately. In many cases the damper communicating directly with the smoke-pipe intended to be opened only in kindling the fire, becomes warped by the heat, so that it can only be imperfectly closed, and much of the heated gases passes through it instead of the heating flues, and thus escapes without having the heat abstracted. The grate should be easily dumped without danger of falling down, as is the case with many ill-constructed furnaces, and the bottom dampers should fit as tightly as possible that the draft may be fully controlled. The outer side of the fire-box and flues should be whitewashed.

The chamber in which the air is heated should be of ample size in proportion to the capacity of the hot-air pipes which lead from it, and should *always* contain a vessel of water.

The cold-air pipe leading to the heating chamber is in most cases too small. We have often seen this pipe having a sectional area of only 72 square inches to supply a hot-air service, the aggregate sectional area of which was not less than 616 square inches; making all due allowance for expansion, the cold air pipe ought to be twice as large in proportion as this.

We have lately seen in an exchange a recommendation that the external openings of the cold-air pipes should be trumpet-mouthed. This was asserted to be a panacea against the effects of varying winds which often reverse currents of air and send the hot current out into the street instead of the parlor or library. We have tried this experiment and know that it will not do. The only thing that will do is a vaned hood, or cowl, which always presents its mouth to the current of wind, no matter from what quarter the wind is blowing.

The hot-air pipes leading from the furnace are apt to get clogged where the registers open in the floor, by servants sweeping all manner of rubbish into them, as dust, bits of rags, etc. This is not only an obstacle to the flow of air but renders the danger that your house may be burned somewhat imminent.

Where, as is often the case, the hot-air registers open out at right angles from the side of a vertical pipe, one over the other, the top room will get the better of the others, unless the supply of hot air be far more than the capacity of the upper register to discharge. The branch register pipes should not join the main pipe at right angles, but at an acute angle, the apex of which is at the junction of the two pipes. Even then it may be necessary to extend a chute or apron from the upper side of the lower end of the branch pipe into the main pipe, so as to partially intercept the ascending current.

Finally, the ventilators should be in the bottom of the room. In this case the hot air which enters the room pure rises to the top, while the foul and effete air settles to the bottom.

AERO-STEAM ENGINES.

Our readers are well informed in the history of the attempts which have been made to substitute air for steam as an expansive agent in engines. With the commencement of these efforts the name of Capt. Ericsson will ever stand as one of the earliest pioneer investigators, and, should the success which is now claimed for the combination of air and steam, applied to the same purpose, be fully realized, that share of the honor attending it will be due to him, justly claimed by those who help to point out the way by which others may mount to success.

To the mechanical engineer the paper bearing the above title, read before the British Association at Exeter, will be one of the most interesting of any of the able and valuable contributions to the transactions of that distinguished body. We can give only a brief review of this paper at this time, but we may perhaps refer to it again at a favorable opportunity.

The first part of the paper was devoted to a review of the data by which it has been satisfactorily established that not more than one tenth of the entire heat of coal is on the average utilized by steam engines.

The author, Mr. Richard Eaton, of Nottingham, England, then discusses the practical difficulties encountered in the effort to substitute heated air for steam, the principal of which is, as our readers are already aware, the effect of highly heated air upon such metals as may be economically employed in the construction of machines.

He then proceeds to give a brief history of the new Aero-steam motor, which avails itself of air expansion, using at the same time steam, which removes the difficulty above mentioned.

Mr. George Warsop, of Nottingham, as the son of an air gun maker there, was born with aerial ideas, and although his only education was received at a Sunday school, and he was sent to work at ten years of age, he turned that education to such good account that before he was twenty he had in leisure moments secretly constructed an air engine. Later in life it was his privilege, while a working mechanic in New York, during his engagement with Mr. Ericsson, to observe the weak points in the system of that highly gifted and persevering inventor, and after years of research to supply the deficiences by a marvelously simple system of mechanism which, as far as present experience goes, promises complete success by means which, happily for the cause of economy and progress, seem compatible alike with physical science and mechanical construction.

In the first attempts at practically carrying out the system, the arrangement adopted was an ordinary high pressure engine with vertical boiler as used where fuel is cheap. An air pump is added, which is put in operation by the action of the steam engine.

Thus, cold air is taken in by the air pump and is forced on in its compressed state through an air pipe, which, in the case before us is conducted first within the exhaust, then in a coiled form down the funnel of the boiler, then past the fire, and finally past a self-acting clack valve at the bottom of the boiler into the boiling water itself, rising naturally through the water, the air is intercepted and subdivided by diaphragms of metal gage. Thus a twofold service is rendered by the contact of the elements, the water becoming aerified and deprived of its cohesion and prompted to a free ebullition, while the air on rising above the water is saturated by the steam, and the two together pass on to their duty in the cylinder where saturation assists lubrication. The agitation of the water prevents scaling.

The machine thus constructed, but having two air pumps, and with cam motions applied to the valves as also to the poppet valves of the working cylinder, gave the following results, results which it must be admitted were sufficiently discouraging to have deterred the inventor and his associates from proceeding further in the matter, but for their faith in the intrinsic soundness of the system, and perseverance in carrying it to a practical issue. The work had to be done under disadvantages of various kinds, on inconvenient premises, which centuries back were a farm house standing within the ancient walls of Nottingham, and until the protection of the patent laws had been obtained, the original apparatus was carefully guarded in an unsuspected attic.

In this form of the apparatus the power obtained by the increased volume of the air forced in by the pump, did not compensate for that consumed in forcing it into the boiler. At the same time there were encouraging indications which led to further experiment. One of the air pumps being discarded, experiments were made with waste holes in the barrel of the other pump, to ascertain what proportion of air admitted to the boiler compensated for compression. It was found that about ten per cent of the effective consumption of fluid in the working cylinder gave much better results. At the same time the cam motions were discarded and the pumps left to their own unaided action. In this form it is claimed that a gain in work done by the combined air and steam engine was made of 42·5 per cent.

Here, although a very remarkable relative economy was apparent, it became obvious on consideration that danger of mistake would arise in assuming this economy as absolute, inasmuch as the duty performed, when contrasted with that obtained from engines of standard types, actuated by steam, was manifestly low, and it seemed probable that, as by judicious improvement in details, the duty was made to approximate more closely to fair steam engine duty, this relative economy might fall off considerably, inasmuch as there would be less margin to economize upon.

With a view of testing this point, and also for the satisfaction of railway engineers, of conducting experiments at locomotive pressures, a thorough remodeling of the whole apparatus was effected. The tappet motions were thrown aside in favor of the usual slide valve arrangement, working with a moderate amount of expansive action. The former wasteful vertical boiler was discarded in favor of a more economical one of the compound or Cornish multi-tubular description, so as to obtain a better evaporative duty from the coal consumed. The radiating surfaces of the cylinder pipes were re-clothed, and the feed water heated by the exhaust steam. Instead of exposing the air pipe to the direct heat of the furnace, as in the former case, the air became thoroughly heated on its passage from the pump to the boiler at a temperature of from 500° to 600° Fah., by being conducted through suitable coils and pipes through the exhaust steam in the heater, and the waste heat in the boiler flues and uptake.

When these changes were made a gain of 47 per cent over steam only, was claimed on an even pressure trial, and a gain of nearly 30 per cent on an open valve trial, a step in advance so huge that it staggers belief.

We shall watch future experiments in this field with the utmost interest in the hope that they may be successful, and that at last some decided progress in the conversion of heat into work has been made. Not that there has been no progress, but what has been made has been slow and painful, compelling, as it were, only a small fraction more of the heat which we know is constantly eluding us, to fall into line and do work. But 30, 40 per cent is something to make an engineer suspend his breath, aye, and his belief too, until the plain proof is before him that the results claimed are really

secured. An illustrated description of this apparatus will be found in another column.

AMMONIA AND ITS USES IN THE ARTS.

Ammonia is, in many respects, a peculiar substance, and much might be said of its composition and chemical relations to other bodies. Our purpose is, however, in the present article, to give only a brief and popular account of its manufacture on an extensive scale, and to say something of its important applications in the arts.

Ammonia has been long known under various names, *aqua caustica*, spirits of hartshorn, sal volatile, and lastly, ammonia, from Ammonium, a district in Africa, taking its name from the Temple of Jupiter Ammon, the salts of ammonia having been formerly obtained there.

The production of ammonia is now very large and necessarily so, as the already large demand for it in the various arts is constantly increasing.

Ammonia has been made by the direct combination of the gases which compose it, namely, nitrogen and hydrogen, but this method has never been made profitable in its manufacture. It is most cheaply and extensively obtained as a collateral product in other manufactures.

It is one of the by-products in the distillation of coal in gas works, and also in the manufacture of boneblack. It has also been made under patent process, which consists in distilling a mixture of two parts of guano with one part of lime, or other caustic alkali, the gaseous ammonia being conducted into water which is thus saturated with it, forming a commercial *aqua ammonia*.

Several other patents have been granted on processes for manufacturing ammonia. One of these is a method for extracting ammonia from gas water. The gas water is put into a retort with slaked lime, and distillation performed as in the guano process.

An improvement was made and patented, 1838, for the production of ammoniacal liquor from gas water, which was a great advance on the old methods, as it enabled the product to be obtained in a concentrated form.

One of the most recent sources of supply has been found in the boracic acid manufactories of Italy, which formerly allowed enormous quantities to be wasted. It is now estimated that over one million pounds of ammoniacal salts are produced by these establishments.

In the beet-root sugar manufacture, large quantities of sulphate of ammonia are allowed to go to waste.

Ammonia has been proposed as a means of generating motive power, but the experiments hitherto tried in this field have not proved very successful, though the liberation of this gas from its salts, in a close vessel, may be made to generate an enormous pressure, and its ready absorption by cold water renders the application of the condenser perfectly easy. One of the obstacles met with in these attempts has been the difficulty of constructing cheap machines out of materials which are not chemically acted upon by this gas, but it still seems to us that the method might be advantageously applied to the generation of motive power under circumstances where steam is not admissible. We do not, however, believe it can be worked as economically as steam for many of the purposes for which it has been proposed.

Machines for manufacturing ice, employing liquid ammonia, have been constructed, on the principle, that when liquids expand into gases, they absorb heat from surrounding bodies. The same principle has, however, been more cheaply applied in the use of volatile hydrocarbons as a substitute for the liquefied ammonia. The details of these different machines are, of course, dissimilar, but the general principle of their operation is the same.

To specify the widely extended and various uses to which this substance is applied in the arts, would compel us to greatly lengthen this article. Suffice it to say, that it is one of those essentials to the present status of the industry of the world, the absence of which would be felt scarcely less than soda or sulphuric acid.

THE EXHIBITION OF THE AMERICAN INSTITUTE.

The fair of the American Institute was duly opened at the Empire Skating Rink, Third avenue, between Sixty-third and Sixty-fourth streets, on the 8th inst., and although things are yet in a somewhat chaotic condition—the department of machinery especially—the signs indicate a brilliant display. The confusion is not due to want of exertion on the part of the managers so much as to the dilatoriness of exhibitors.

None of the machinery was running at the time of our going to press, though there will be no long delay.

None of the departments was complete at the time of our visit; the art department being specially meager. There are one or two crayon portraits worthy of special notice, but beyond this and some excellent photographs, there was very little worth seeing.

The exhibition of the American Association of Wool Manufacturers is undoubtedly destined to be one of the most interesting and attractive features of this fair. The following mills are already represented: The Lawrence and Pacific Mills, Lawrence, Mass.; Hamilton Woolen Co., Lowell, Mass.; Wm. Duncan & Son's Mills, Franklin, N. J.; Eddy & Son's Mills, Fall River, Mass.; Lawrenceburg Woolen Mills, Lawrenceburg, Ind.; Hockanum Company, Rockville, Conn.; Harris Woolen Mills, Woonsocket, R. I.; Weybosset Woolen Mills, Providence, R. I.; Central Woolen Mills, Uxbridge, Mass.; Elba Woolen Mills, Providence, R. I.; Rock and New England Manufacturing Companies, Rockville, Conn.; American Mills, also of Rockville, Conn., Kernan and Helm, Utica, N.Y., and others whose goods were not yet displayed, and the names of which we could not learn. The goods in this department already on exhibition are such as to excite the pride of every one who has the prosperity of American industry at heart.

In the machinery department the only things which were arranged were two fine cases of saws, one from Hoe & Co., New York city, and the other from the American Saw Co., also of this city.

Passing from this department we observed a fine collection of agricultural machinery, which we will notice more in detail hereafter. Near this collection stands a beautiful show table of paints, exhibited by Devoe & Co., 117 Fulton street, New York. A great deal of taste is displayed in the arrangement of this table, and the samples of colors exhibited are very fine.

The soda-water fountain exhibited by John Matthews, of this city, is one of the most beautiful designs we have ever seen.

The silk department will attract much attention. Although necessarily much smaller than the exhibition of woolen goods, it is, considering the comparatively recent period since the silk manufacture could be ranked as an American industry, a very remarkable display. Among the establishments represented here we notice P. G. Gimraud, Paterson, N. J.; Frederick Bane, Schoharie, N. Y.; Dale Manufacturing Co., Paterson, N. J.; Cheeney Bros., Hartford, Conn.; W. H. Horstmann & Sons, Philadelphia, Pa.; J. S. Shafter, Paterson, N. J.; and the Oneida Community, of Oneida, N. Y.

We shall give more detailed attention to the various departments in future issues, and we congratulate the managers of the fair on their prospects of success. The exhibition will, undoubtedly, be one of the best ever held under the auspices of the American Institute.

On Friday evening the fair was honored by a visit from President Grant, who was escorted through the several departments by the Hon. Orestes Cleveland, Chairman of the Board of Managers. He spent considerable time in the woolen department, and he was apparently well pleased with the numerous beautiful products of American industry to be seen both there and in all the other departments of the fair. His presence created a great deal of enthusiasm among the large assemblage, and he was repeatedly cheered, while the band played "Hail to the Chief," and other appropriate airs.

AN EXAMPLE FOR YOUNG MEN.

The career of Gen. John A. Rawlins, the late Secretary of War, who paid the forfeit of life in the service of his country, is a striking illustration of the fact that honor and fame are open to all in this country who unite ability with ambition and integrity. Gen. Rawlins was the son of a poor charcoal burner, who resided at Guilford, Ill., and was compelled to follow his father's trade. In the mean time he was ambitious to rise above his humble position, and earnestly applied himself to the study of books, and was finally admitted to the bar at Galena, where he not only gained an honorable practice, but won a good name, and a host of true friends.

At the outbreak of the war, Grant discovered the sterling merits of this man Rawlins, and from that time they became inseparable friends and co-laborers in the nation's cause. Grant became President, and Rawlins was made Secretary of War—fulfilling all duty assigned to him ably and well.

He died poor, and the keen instincts of our people at once appreciate the character and services of such a man. He could have made himself rich through the many opportunities that came in his way as chief of Gen. Grant's staff, but, like his illustrious superior, he was above the temptation to abuse the confidence of a sacred trust—a rare thing in these days.

The widow and children of the noble Rawlins are left poor by his death, but a purse of $50,000 has been subscribed, or nearly so, in this city to relieve them from want. If republics are ungrateful the people are not.

RAINLESS DISTRICTS---FREAKS OF THE WEATHER.

In several parts of the world there is no rain at all. In the Old World there are two districts of this kind: the Desert of Sahara in Africa, and in Asia part of Arabia, Syria, and Persia; the other district lies between north latitude 30° and 50°, and between 75° and 118° of east longitude, including Thibet, Gobiar, Shama, and Mongolia. In the New World the rainless districts are of much less magnitude, occupying two narrow strips on the shores of Peru and Bolivia, and on the coast of Mexico and Guatemala, with a small district between Trinidad and Panama on the coast of Venezuela.

Per contra—the climate of the Khasia Mountains, which lie northeast from Calcutta, is most remarkable for the excessive fall of rain. An English traveler established the fact that in the month of August, 1841, there fell 264 inches of rain. This great rain fall is attributed to the abruptness of the mountains that face the Bay of Bengal and the intervening flat swamp 200 miles in extent. It is not easy always to account for the erratic conduct of the weather upon any established scientific theory, for it is asserted that there is a district in Siberia in which, during winter, the sky is constantly clear, and where a particle of snow never falls.

THE ROOT STEAM ENGINE COMPANY are placing in the Fair of the American Institute, one of their 120-horse power boilers, which is exciting considerable interest among steam engineers. For safety and economy of fuel, large claims are made by the manufacturers. The Company is now composed of some of our shrewdest business men, who have placed sufficient capital at their disposal to enable them to fill extensive orders.

THE HUMBOLDT CENTENNIAL CELEBRATION.

Alexander von Humboldt was born in the city of Berlin on the 14th September, 1769. The occurrence of the centennial anniversary of the birth of this great man was commemorated in his native city by the dedication of a national monument with appropriate ceremonies. In New York city also, a colossal bronze, representing him in the prime of life, was unveiled. Professor Francis Lieber delivered an appropriate address in German, followed by one in English by Professor Doremus. Numerous German singing societies took part in the celebration, and a banquet was given at Irving Hall.

It was generally supposed that Humboldt was little known and not much appreciated by the people at large on account of the fact that his works are so learnedly written that they can only be perused by one who is already in possession of a considerable amount of scientific knowledge. No supposition can be more erroneous than this. In the winter of 1827–8 Humboldt delivered in his native city, Berlin, a course of sixty-one lectures, commencing November 3d and concluding on the 26th of April. These lectures formed, as it were, the first sketch of the "Cosmos," published subsequently, and were especially arranged for the people at large, those that had not enjoyed the advantages of higher education.

Some scientists of an inferior rank would perhaps have considered it beneath their dignity to appear as teachers. Humboldt did not, though he was then Baron, Chamberlain, Councilor, and confidential adviser of the king.

The inhabitants of Berlin and Potsdam all knew him personally, and showed him as much honor as to a king. With a slow but firm step, the head slightly bent forward, one arm at his back, holding a pamphlet, he was often seen passing through the streets. Wherever he appeared he was received by tokens of reverent esteem, the passers-by stepping aside through fear of disturbing him in his thoughts, and one was often heard saying to his neighbor, "There goes Humboldt."

The following instance goes to prove what reverence even the lowest classes paid him. During the time of the revolution, in 1848, a troop of bristly fellows stormed his house, ignorant of the fact that they were in the residence of the great *savant*: "I have no weapons, my boys; I am an unpretending philosopher, and my name is Humboldt"—uttered a small, bowed, and white-haired figure. "Back!" called the commander of the troop, "this is our great citizen Humboldt; four men remain before his house to watch that no wrong is done to him."

The following sketch of this great man is from the pen of Dr. Francis Lieber:

Who has not enjoyed the pleasure of finding the spots on the chart of human progress where you put down your finger and say, here is Aristotle, and here again; here is Hildebrandt, here is the conquest of Constantinople traced even in the discovery of our continent, even in Descartes and Bacon; here are the causes and the effects of the University; and to trace the lines of civilization radiating in different directions, from point to point? And this delight we may enjoy when meditating on the period of which Humboldt was one of the most distinct exponents. We enjoy it even now, although he has left us but yesterday; for God allowed to him days so long that he passed into history before he passed away from among us. Humboldt died as old as Sophocles.

Humboldt received the living traditions of the great circumnavigator, Cook, through Foster, Cook's companion, and lived to gather facts for his Cosmos from the latest reports of the geological surveys of our States. He lived when Voltaire died, and must have grown up with many French ideas floating around him, for Humboldt was a nobleman whose family lived within the atmosphere of the Berlin court; and he lived to witness the great revolutions in literature as well in Germany as in France and England. He lived when Rousseau died (the same year that Voltaire deceased), and must have remembered, from personal observation, that homage, which even monarchs paid (at a distance, it is true) to the Contrat Sociale, and he outlived, by some weeks, De Tocqueville. He lived through the period of the American Revolution, was a cotemporary of Washington and Adams, and a friend of Jefferson. He lived through the French Revolution and the age of the classic orators of Britain. He lived through the Napoleonic era and the resuscitation of Prussia and of all Germany. He studied under Werner, with whom mineralogy begins, and knew Houy. He knew La Place, survived Arago and Gauss, and worked with Enke. He lived with Kant, and knew Schelling and Hegel. He knew Goethe and read Heine. He read "Gibbon's Decline" as a work of a living author, and perused Niebuhr, and later still praised Prescott. He grew up in the Prussian monarchy according to the type of Frederic the Great, and with the fresh reminiscences of the Seven Year's War, and left it changed in army, school, government—in everything. He saw the beginning of the Institute of France, and lived to be considered by its associates as one of its most brilliant ornaments at its most brilliant period. He lived through the periods which distinctly mark the science of chemistry, from Lavoisier to Rose and Liebig. Humboldt was seventeen years old when the great king, perhaps the most illustrious despot of history, died so tired by the genius of his own absolutism that we cannot forget the words of the dying king; "I am weary of ruling over slaves;" and he lived through the whole period of growing popular sentiments and habits, of constitutinal demands, and revolutionary, fearful conflicts. He wore the lace and ruffle of the last century, and the more practical dress of our times. Yet no one ever heard from him any useless regret for what had passed and was gone. I have heard him speak with warmth of noble things and men that he had known, but not with gloomy despair of the present or the future.

What an amount of thinking, observing, writing, travel-