enough upon the subject to get a glimpse of possibilities in this direction which an expert might easily develop.

We trust that Mr. Graham, who has done so much for the cause of brief writing in this country, will examine these possibilities, as we are confident such examination will lead his active mind into a new and interesting channel.

## RADIATION OF HEAT.

We not long since briefly discussed the communication of heat by convection and conduction, endeavoring to place in a prominent light some popular errors upon these subjects, and mistakes in the construction of steam boilers, refrigerators, etc., resulting from such errors. It will not be amiss to notice the third way by which heat is transmitted, namely, radiation.

The term, radiation, itself indicates the chief peculiarity of this mode of transmission. All the so-called radiant forces, as heat, light, attraction, etc., act from a center outwards, and all other things being equal, they act equally *in all directions*, the straight diverging lines in which they act being called rays. It must be borne in mind here, that the word center, as used above, is not employed in its strict mathematical sense, but rather means the source from which the heat or light is derived, as these modes of motion may often be generated wholly upon the surfaces of bodies.

Although, to explain the radiation of heat and light through apparently absolute space, a medium called "ether" has been supposed to exist, and although this hypothesis most admirably accounts for the principal phenomena of radiation, and changes in the direction of radiation by refraction and reflection, and though this fact gives such an hypothesis a strong claim to the very general acceptance it has received, still we must remember that it is not a demonstrated fact.

It is not, however, necessary to our present purpose to dwell upon this point, as we wish only to notice some of the most leading facts of radiation, considered in their practical application to the arts, and some facts which have been recently discovered.

A common error is the idea that "heat rises." We have already alluded several times to this error, and shown its fallacy, and we will not dwell upon it now. Suffice it to say that only when the source of heat is placed in a circulating medium, does heat even *appear* to rise.

A heated body, placed within a space void of any liquid or gaseous medium, will radiate heat *in all directions*, the intensity of the heat at any point being to the intensity of the heat at any other point inversely as the squares of the respective distances of the points from the radiating body. This is a fundamental law of radiation, which experiment has demonstrated beyond dispute.

Experiment has also demonstrated that heat radiation is affected by the physical characters of the surfaces of the radiating bodies, and this point is of considerable importance in the arts. Kettles, with smooth polished bottoms, transmit heat to the liquids contained therein much less rapidly than those the bottoms of which are blackened and rough. A steam boiler well lagged, and having the lagging inclosed by polished sheet metal, retains its heat better than by the use of the lagging alone.

Dark colored bodies radiate heat more rapidly than light colored ones. They also absorb heat to a greater extent than light colored and polished bodies. Ice would keep much longer in a bright tin pail than in a dark and roughened one. The polishing of stoves, while it improves their appearance, diminishes their radiating power.

The power of radiation is diminished by hammering and rolling metal. A hammered copper vessel is therefore not as rapid a radiator of heat as a cast one. We have often heard people wonder why copper sauce pans tinned on the interior, are preferred over all others by professional cooks. The reason is that they do not absorb and transmit heat so rapidly as vessels of iron or tin plate. They are hammered out by the coppersmith, who leaves their bottoms quite thick in proportion to the sides. The metal is thus consolidated, and being brightly tinned on the inside, and kept bright externally, the heat cannot pass through them faster than the evaporation of their contained liquids can convey it away. Thus a cook may have twenty different sauces all boiling at once, and yet he has no fear that any of them will scorch. The same reason is doubtless the basis of the favor with which copper is regarded for vessels used in distilling, sugar refining, etc.

All, or nearly all the heat existing upon the surface of the earth, may be properly traced to the radiated heat of the sun. This heat converted into various forms of force, or, according to many modern thinkers, "modes of motion," is reconverted into heat motion again in the combustion of coal, and other chemical reactions, in friction, electric resistance, etc.

Sir John Herschel and M. Pouillet found that, were no heat absorbed by the atmosphere, about 83 foot-pounds per second would fall upon a square foot of surface placed at right angles to the sun's rays. Mr. Meech estimates that the quantity of heat cut off by the atmosphere is equal to about 22 per cent of the total amount received from the sun. M. Pouillet estimates the loss at 24 per cent. Taking the former estimate, 64·74 foot-pounds per second will therefore be the quantity of heat falling on a square foot of the earth's surface when the sun is in the zenith. And were the sun to remain stationary in the zenith for twelve hours, 2,796,768 foot-pounds would fall upon the surface.

The last number of *Silliman's Journal of Science* contains an account of some investigations made by the celebrated Magnus—whose death we recently announced—on heat radiated at low temperatures. It is supposed this was his last work previous to his death.

We will close the present article by transcribing the results he obtained:

"Different bodies at 150° C. radiate different kinds of heat. These kinds of heat are more absorbed by a substance of the same kind, as the radiating body, than by others, and this absorption increases with the thickness of the absorbent.

"There are substances which emit only one or a few kinds of heat, others which emit many kinds.

"To the first of these belong rock salt when quite pure. Just as its ignited vapor, or that of one of its constituents, sodium, radiates but one color, so rock salt, even at a low temperature, emits but one kind of heat. It is monothermic, as its vapor is monochromatic.

"Rock salt even when quite clear, emits, together with its peculiar rock-salt heat, heat which is not more absorbed by a plate of rock salt 80 mm. in thickness, than by one 20 mm. in thickness.

"Rock salt absorbs very powerfully the heat it radiates. It therefore does not, as Melloni supposed, allow all kinds of heat to pass through it with equal facility.

"The great diathermancy of rock salt does not depend upon its less power of absorption for different kinds of heat, but upon the fact that it radiates only one kind of heat, and consequently absorbs only this one, and that almost all other substances send out heat containing only a small fraction or none of the rays which rock salt emits. But all rays which differ from those radiated by any substance, are not absorbed by it, but pass through with undiminished intensity. From this we may infer that every substance is diathermanous, only because it radiates but few waves of quite definite length, and consequently absorbs only these, allowing all the others to pass through.

"Sylvin (native chloride of potassium) behaves like rock salt, but is not monothermic to the same extent. In the case of this substance also an analogy exists with its ignited vapors, or those of potassium, which, as is well known, yield a nearly continuous spectrum.

"Fluor spar completely absorbs pure rock-salt heat. We ought, therefore to expect that the heat which it emits will be equally absorbed by rock salt. Nevertheless, 70 per cent of this heat can pass through a rock-salt plate 20 mm. in thickness. This may doubtless be easily explained with reference to the quantity of heat which fluor spar emits in comparison with that of the rock salt; still it is possible that fluor spar at 150° emits rays other than those which it absorbs at ordinary temperatures. This behavior is however probably connected with the great reflecting power of fluor spar for rock-salt heat.

"If it were possible to produce a spectrum of the heat radiated at 150° C., the spectrum would, if rock salt were the radiating body, exhibit only one luminous band. It sylvin were used as a radiator, the spectrum would be much more extended, but would still occupy but a small portion of the spectrum which the heat radiated from lamp-black would form."

## THE COMMISSIONER SUSPENDS A PATENT AGENT FOR GROSS MISCONDUCT.

Section 17th of the Act approved July 8, 1870, provides, "that for gross misconduct the Commissioner may refuse to recognize any person as a patent agent, either generally or in any particular case; but the reasons for such refusal shall be duly recorded and be subject to the approval of the Secretary of the Interior."

The Commissioner, indeed, has had this power since 1861, but during all that time, so far as we know, the penalty has not been inflicted until now upon any agent practicing before the office. Some complaints, however, have been made against agents for irregularities, and we have reason to know that ex-Commissioner Foote had occasion to regret his leniency in one particular case of a Washington agent, who had violated the confidence of the Office by writing to the clients of another agency during the pendency of the application.

The case brought to the notice of Commissioner Fisher was that of a firm styling themselves "McGill, Grant & Co.," of Washington City, who are charged on seven distinct counts with the crime of misappropriating the moneys of their clients, and in maintaining a false correspondence in relation to the progress of business within the Patent Office.

George W. McGill, senior member of the firm, entered a general plea that the irregularities in the practice as complained of, were the result of having intrusted their Patent Office business to an irresponsible and drunken clerk. The Commissioner, however, refused to accept this answer, inasmuch as all the correspondence of the firm appears to have been carried on in McGill handwriting; and the order of the Commissioner is, "that the said firm of McGill, Grant & Co., as well as the said George W. McGill, be hereafter excluded from practicing before the Patent Office in any and all cases."

McGill has appealed to the Secretary of the Interior to examine his case, and the matter is to undergo further investigation by that official, who directs that the publication of the order be suspended.

## THE PRESENT EUROPEAN WAR.

Doubtless all our readers are deeply interested in the great struggle now going on between France and Prussia. While the general discussion of its causes and probable political effect upon European affairs is foreign to the scope of our paper, we cannot refrain from calling attention to an article copied from the New York *Times* of August 17, which is decidedly the best explanation we have yet seen of the causes of the recent disasters to the French army and the success of the Prussians.

In our tour through Prussia in 1867 we were most deeply impressed with the great military strength of the nation. Not only had this kingdom at that time added to the martial spirit of its citizens by a most brilliant military success against Austria, but it was evident that in point of military organization, in the character of her arms, and the *morale* of her troops, she was then, as now, the most formidable military power in Europe.

In a letter published in this journal in August of that year we expressed the belief that the people of Prussia anticipated another war. Whether that surmise was correct or otherwise, certain it is that the event has found them fully prepared for the emergency.

Should the present war result, as now appears likely, in the defeat of France, the first rank in military prowess among the nations of Europe must be accorded to Prussia.

Our readers will find the article to which we have called attention full of instructive interest in this connection. As a fair, candid review of the situation, we commend it to their attention.

## THE USE OF TORPEDOES FOR COAST DEFENSE.

It appears that the Prussians, not having a navy equal to the French, have laid a regular network of torpedoes along their Baltic coast, and at the mouths of the rivers Ems, Weser, and Elbe. Both classes of torpedo are said to be in use, the charge being in general dynamite, which, although a dangerous, is a fearfully explosive material. Many of these torpedoes are believed to be mechanical, and, if so, are exceedingly dangerous to both friends and foes. Others are arranged on the ordinary electrical principle, and are perfectly safe except when the electric communications are established. Thus the navigation of the coast, with its rivers and harbors, is quite open to the friendly ship. The merchantman fleeing like the dove from the hawk may safely steer over and among the hidden mines; yet the next moment, by the mere turn of a key, the channel may be effectually closed to the pursuer. The torpedo is the war ship's *bete noir*. The proudest iron-clad that ever floated is powerless against these submerged volcanoes.

Many English sailors remember the Russian torpedoes during the Crimean war. Harmless and insignificant as they were, yet they caused a good deal of trouble; and if they had only been on half or quarter the scale of the present mines, several English ships would be now lying in Baltic mud. We shall not be the least surprised, therefore, some morning to hear of the sudden disappearance of a nautical belligerent.

## DEATH OF PROFESSOR PALMSTEDT.

The death of this distinguished chemist, the friend and cotemporary of Berzelius, occured at Stockholm, on the 6th of April, 1870, at the advanced age of 85. He devoted his long life to the good of his country. For twenty four years he was director of the polytechnic school at Gotheoburg, and was thus enabled to introduce into Sweden the inventions and improvements of other countries. Technology and agriculture were his chief studies. He was the leading spirit in the organization of new schools and public exhibitions, and at the time of his death was actively engaged on a committee for the arrangement of a permanent exhibition of the products of Swedish industry, in Berlin. He made numerous journeys into foreign countries, the results of which have been published in Sweden—and among his papers have been found an extensive correspondence with nearly every chemist of note of the present century; among his letters, are 268 from Berzelius, which will be published by his executors, and doubtless throw much light on the history of chemistry.

He was a true patriot, an unselfish scholar, a useful man, and his death will be severly felt in Sweden.

## SCIENTIFIC INTELLIGENCE.

### TETRABROMIDE OF CARBON.

Messrs. Bolas and Groves have succeeded in preparing the tetrabromide of carbon for the first time, by heating together in a sealed tube, at a temperature of 150° C. (302° F.), for about 48 hours, two parts of bisulphide of carbon, fourteen parts dry bromine, and three parts iodine. and subsequently distilling the product off of a caustic soda solution, dissolving in hot spirits, and allowing to crystallize.

The tetrabromide of carbon is a white solid, crystallizing in lustrous plates, and melting at 195° F. It has an ethereal odor, somewhat resembling that of tetrachloride of carbon, and a sweetish taste—nearly insoluble in water, but easily dissolved in ether, bisulphide of carbon, tetrachloride of carbon, chloroform, bromoform, benzole, petroleum, and hot alcohol. It is not particularly acted upon by aqueous solutions of caustic soda and potash, or cold sulphuric acid, and with care can be sublimed unchanged. The authors have not had time to investigate the action of this interesting compound upon silver salts, ammonia, nor its physiological relations. It may prove to be a valuable salt in photography, as well as in medicine, and hence we have given a full notice of it.

### ACTION OF SULPHURETED HYDROGEN ON THE SYSTEM.

Max Schaffner has recently made some observations on the action of sulphureted hydrogen that are worthy of publication, as the facts are not generally known.

When a workman remains for days or weeks in an atmosphere containing a very small quantity of sulphureted hydrogen, the symptoms are loss of appetite and headache. The sudden respiration of a large quantity of the gas produces immediate insensibility, as if the person had been shot by a bullet, all the muscles become rigid and motionless, the eyes are staring, and the lungs give out a rustling sound. Brought into the open air, and the head washed with cold water, the patient revives in a few minutes, and complains of lassitude, but not of any pain. Too long delay in such an atmosphere

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