

offense charged is clearly a crime within the meaning of the Penal Code."

At this time, when the inconsistencies in the copyright law are being considered with a view to the enactment of a new law in which they will be remedied, it is hoped that Congress will consider the question of the insertion of a provision in the statutes which will make the willful infringer of a copyright subject to such damages and penalties as will act as a deterrent and will make it possible for authors and artists to recover a more reasonable sum as damages for infringements instead of penalties, which are difficult to obtain judgment on and are often small in amount, with the necessity of dividing them with the United States.

VANDERBILT CUP ELIMINATION TRIALS.

Of recent years the elimination trials for the international automobile races have assumed an importance, and excited an amount of interest, second only to that of the races themselves. The elimination trials to select the five machines which are to represent America on the 14th of October next in the annual race for the international trophy, presented by Mr. Vanderbilt, were run off most successfully on September 23. They were held over the same course on Long Island on which the cup race will take place; and the careful work which has been done, in oiling the road and banking the sharp turns, appears to have produced a better race-track and certainly one incurring less risks than that over which the race of last year was held. The starting point was at Mineola, and the first few miles as far as Jericho were over roads that formed a part of last year's course. At Jericho, however, the course turned to the left toward the Sound, and passed through East Norwich, Greenvale, by Lake Surprise, through New Hyde Park, and back to Mineola. In the cup race, ten circuits of the course will be made. In the elimination trials, however, the cars made the circuit of 28.3 miles only four times; the total length of the race, as thus run, being 113.2 miles.

The list of entries included twelve different cars, and of these ten were sent off promptly at two-minute intervals. The starters included a Haynes car, two Pope-Toledo's, a Matheson car, a White steamer, a Locomobile, a Christie, a Royal Tourist, a Thomas, and a Franklin. The fastest time was made by a Pope-Toledo, 60-horse-power machine, which covered the course in 2 hours, 0 minutes, 50 seconds, at an average speed of 56.20 miles per hour, the fastest lap being run in 27 minutes 58 seconds. The next fastest time was made by a 90-horse-power Locomobile, in 2 hours, 1 minute, and 49 seconds. Then followed the 40-horse-power Royal Tourist in 2 hours, 19 minutes, and 18 seconds; the 50-horse-power Haynes in 2 hours, 23 minutes, 32 seconds; and the 60-horse-power Thomas, which made the circuit in 2 hours, 29 minutes, and 40 seconds. A marked feature of the running of the successful cars was that they maintained a remarkably uniform speed, a fact which augurs well for their performance when they compete with the foreign entries over the 283-mile course on October 14.

IS RADIUM THE CAUSE OF THE SUN'S HEAT AND LIGHT?*

BY PROF. G. H. DARWIN.

If, as has been argued, tidal friction has played so important a part in the history of the earth and moon, it might be expected that the like should be true of the other planets and satellites, and of the planets themselves in their relationship to the sun. But numerical examination of the several cases proves conclusively that this cannot have been the case. The relationship of the moon to the earth is, in fact, quite exceptional in the solar system, and we have still to rely on such theories as that of Laplace for the explanation of the main outlines of the solar system.

I have not yet mentioned the time occupied by the sequence of events sketched out in the various schemes of cosmogony, and the question of cosmical time is a thorny and controversial one.

Our ideas are absolutely blank as to the time requisite for the evolution either according to Laplace's nebular hypothesis, or the meteoric theory. All we can assert is that they demand enormous intervals of time as estimated in years.

The theory of tidal friction stands alone among these evolutionary speculations in that we can establish an exact, but merely relative, time-scale for every stage of the process. Although it is true that the value in years of the unit of time remains unknown, yet it is possible to determine a period in years which must be shorter than that in which the whole history is comprised. If at every moment since the birth of the moon tidal friction had always been at work in such a way as to produce the greatest possible effect, then we should find that sixty million years would be consumed in this portion of evolutionary history. The true period must be much greater, and it does not

* Abstract from an address delivered before the British Association for the Advancement of Science, Johannesburg, South Africa, August 30.

seem unreasonable to suppose that 500 to 1,000 million years may have elapsed since the birth of the moon. Such an estimate would not seem extravagant to geologists who have, in various ways, made exceedingly rough determinations of geological periods.

As far as my knowledge goes, I should say that pure geology points to some period intermediate between 50 and 1,000 millions of years, the upper limit being more doubtful than the lower. Thus far we do not find anything which renders the tidal theory of evolution untenable.

But the physicists have formed estimates in other ways which, until recently, seemed to demand in the most imperative manner a far lower scale of time. According to all theories of cosmogony, the sun is a star which became heated in the process of its condensation from a condition of wide dispersion. When a meteoric stone falls into the sun the arrest of its previous motion gives rise to heat, just as the blow of a horse's shoe on a stone makes a spark. The fall of countless meteoric stones, or the condensation of a rarefied gas, was supposed to be the sole cause of the sun's high temperature.

Since the mass of the sun is known, the total amount of the heat generated in it, in whatever mode it was formed, can be estimated with a considerable amount of precision. The heat received at the earth from the sun can also be measured with some accuracy, and hence it is a mere matter of calculation to determine how much heat the sun sends out in a year. The total heat which can have been generated in the sun divided by the annual output gives a quotient of about twenty millions. Hence it seemed to be imperatively necessary that the whole history of the solar system should be comprised within some twenty millions of years.

This argument, which is due to Helmholtz, appeared to be absolutely crushing, and for the last forty years the physicists have been accustomed to tell the geologists that they must moderate their claims. But for myself I have always believed that the geologists were more nearly correct than the physicists, notwithstanding the fact that appearances were so strongly against them.

And now, at length, relief has come to the strained relations between the two parties, for the recent marvelous discoveries in physics show that concentration of matter is not the only source from which the sun may draw its heat.

Radium is a substance which is perhaps millions of times more powerful than dynamite. Thus it is estimated that an ounce of radium would contain enough power to raise 10,000 tons a mile above the earth's surface. Another way of stating the same estimate is this: the energy needed to tow a ship of 12,000 tons a distance of 6,000 sea miles at fifteen knots is contained in twenty-two ounces of radium. The "Saxon" probably burns five or six thousand tons of coal on a voyage of approximately the same length. Other lines of argument tend in the same direction.

Now, we know that the earth contains radio-active materials, and it is safe to assume that it forms in some degree a sample of the materials of the solar system; hence it is almost certain that the sun is radio-active also.

This branch of science is as yet but in its infancy, but we already see how unsafe it is to dogmatize on the potentialities of matter. It appears, then, that the physical argument is not susceptible of a greater degree of certainty than that of the geologists, and the scale of geological time remains in great measure unknown.

PATENTS FOR EXPORTED ARTICLES.—PRACTICAL ADVICE TO MANUFACTURERS.

Consul-General Mason contributes a report from Mr. Robert Grimshaw on the importance of securing patents on articles imported into Germany when such articles are patentable. His letter follows:

"I have often had occasion to write American manufacturers and exporters on the subject of having what they have to sell in Europe patented in the countries where they wish to sell them, and in some cases what I have to say has taken effect. But I should be glad of an opportunity to say, for the benefit of manufacturers as a class and for that of American export trade as a whole, some of the things that I have said from time to time to individuals. From the point of view of the manufacturer patenting is desirable, because it prevents the foreigner from doing what he has otherwise every legal right to do at any time that he sees that a foreign invention is meeting with success, and possibly success at his expense, in that it is being sold in his territory and supplanting his own products, viz., make and use of it.

"From the point of view of the selling agent in Europe, who is asked to spend time and money doing missionary work, the desirability of patenting the new thing is evident from the first, and the conviction strengthens with the success of the agent in the unprotected territory. For the manufacturer has at least the protection of home patents, and if through leaving himself unprotected he loses his foreign fields, he has at

least his own country to work in with no one to say him nay. But the selling agent abroad, who has put in hard work to convince a very conservative public of the superiority of the new thing (a task which is none of the lightest, especially if there is a marked difference in first cost against the novelty) is cut out completely. This digging wells half down to water is seldom relished even by the most philosophic and philanthropic of agents.

"But when we consider the question solely from these two standpoints we have still by no means got a full view thereof. There is the customer to consider. He does not want to buy a lawsuit with a machine or other purchase. In case the article to be sold is not patented in the country in which it is offered for sale there is the danger that it has already been patented by another, and that the patentee will very justly bring against the purchaser an action for infringement of his chartered rights. In this danger the resident agent—the missionary—participates. It is useless to assure the customer that the manufacturer is one of the largest concerns in his native country, and will protect the purchaser against any possible suits for infringement. In the first place the customer has no means of verifying the statement about the financial weight of the manufacturer, and in the second he does not care; he does not wish to be annoyed by any suits, no matter how heavily he may be backed up. In the third place, if he knows anything about German patent law, and the case is a German one, he will quietly remind the missionary that in that country the infringement of a patent is not merely a civil but a criminal offense; and no manufacturer in America, however influential in financial circles, can get around that part of the difficulty. Section 36 of the German patent law of April 7, 1891, says: 'Whoever knowingly uses an invention contrary to the ordinances in sections 4 and 5 will be punished with a fine of 5,000 marks or with imprisonment not to exceed one year.' The quoted sections 4 and 5 are those which secure to the inventor the sole rights of the invention which he patents.

"Further, there are many manufacturers who seek to convey to their agents and to the customers the impression that the matter is patented in the country of sale, not by directly saying so, but by implication. Sometimes this implication is only one of silence; but for all that the attempt, whether unlawful or not, is dangerous in most countries, and especially in Germany. For section 40, of the law already quoted, says distinctly that whoever marks objects or their packages with any sign calculated to impress one falsely with the idea that the object is patented according to the German law shall pay a fine of 1,000 marks. I had been for months in correspondence with the European general agency of an American manufacturer. To get a definite answer, or even any answer at all as to patents, was next to impossible. At last, however, I got the following: 'Our friends, the ——— Company, apologize for the delay in answering our letters about patents, which they say has occurred through oversight. They write: "As you may be aware, probably, we have a great number of persons applying for patents in our own and foreign countries, and to possess you of definite information concerning them would be rather a difficult matter. It will, however, suffice and be entirely satisfactory to you to say that we will fully protect our customers against damages resulting from any lawsuits brought against them by reason of the use of our devices."'"

THE CURRENT SUPPLEMENT.

Dr. Alfred Gradenwitz opens the current SUPPLEMENT, No. 1552, with an article on Improved Methods of Tele-Photography, illustrating his article with actual photographs. Hydrocarbon Oils and Their Value as Lubricants has been taken as the subject of a very thorough article by Frank Harris Floyd. Unquestionably one of the most important investigations in physiological chemistry at the present time is the study of soluble ferments. These are briefly and yet comprehensibly reviewed by Mr. J. H. Long. While there are but few scientific workers who are not more or less expert photographers, few of these possess an adequate knowledge of the laws which define the reactions of the photographic dry plate. For such, a paper by C. E. Kenneth Mees, on the Testing of Photographic Dry Plates, will prove of exceptional value, inasmuch as the paper is both exhaustive in its treatment and copiously illustrated. Robert H. Smith writes on High-Speed Steam and Electric Railways. Albert Mann presents a scientific and yet an absorbingly interesting account of Diatoms, supplementing his text with many excellent illustrations. Clarence M. Weed gives the result of some experiments in destroying black flies. Sir William White writes on submarine signals. A thorough article on the first producer-gas boat is published, which fittingly describes one of the most noteworthy technical achievements of recent years. Sir William Crookes's article on Diamonds is continued.