SCIENCE

FRIDAY, MARCH 2, 1888.

AT THE LAST MEETING of the Washington Philosophical Society, Mr. William Hallock presented a very noteworthy communication upon the formation of fusible alloys. Wood's alloy, which melts at about 64° C., is composed of lead, tin, cadmium, and bismuth, and the lowest melting-point among its constituents is 230° C. Mr. Hallock finds, however, that when the several metals are mixed together in filings, and exposed for twenty-four hours to the heat of an ordinary water-bath, the alloy is produced, and the mass becomes fluid. So, also, when freshly cut slices of sodium and potassium are simply pressed together at ordinary temperatures, liquefaction at once begins, and the fluid alloy is formed. In brief, it seems probable that the phenomena may be generalized, and that all fusible alloys may be obtained from their solid constituents at temperatures very slightly in excess of the melting-points of the compounds. Previous fluidity of either constituent is not necessary. It will be seen that these results bear directly upon the work reported by Spring, who claimed to obtain fusible alloys by pressure alone, but who neglected to prove that the temperature of his materials never at any point reached 70° C. Probably, also, Mr. Hallock's discovery may have decided bearing upon certain questions of molecular dynamics. His results are extraordinary, but it is more extraordinary that the phenomena had escaped notice hitherto.

A WRITER on the psychology of acting, in *Longman's Magazine*, has introduced the inductive method into the solution of problems connected with the histrionic art. The question has often been debated, whether the effective personation of a part requires a real experience of the emotions concerned, so that it is acting only in the sense of artificially exciting a series of emotions; or whether the whole performance is a piece of art, with the emotions, or what to the audience shall stand for such, as entirely assumed as is the costume. The writer in question has addressed a circular upon this and allied topics to members of the actor's profession, and the majority of his answers decide in favor of the real emotion. The emotion of grief is taken as the typical one; and here the sad expression is, as a rule, not put on, but is the counterpart of a real sympathetic state. Real tears flow, often to the extent of interfering with distinct articulation; nor can the impression be at once shaken off upon leaving the stage. A pertinent instance is cited of an actor and an actress having to perform a touching scene many scores of times, and each night resolving 'not to make fools of themselves' by sobs and tears; but each night they broke down, and showed the reality of their emotions. Another actress is reported as saying that if she could play whatever piece most suited her humor each evening, her task would be a much easier one. The general verdict is, that the greatest success is produced by a real emotion. If one regards the performances of persons in the hypnotic condition as 'acting' in this sense, this is precisely the conclusion that the psychologist would expect. It is, however, not a universal experience, some actors testifying that their performance is almost entirely a planned, cool, intellectual artifice; nor are such actors absent among the 'stars' of the profession. That the assumption of a *rôle* can by repetition become sufficiently assimilated to be taken up by the automatic self, is shown by the experience of a very celebrated actress, who played the 'potion scene' in 'Romeo and Juliet' without knowing it, and could only with the greatest difficulty be prevented from playing the scene over again, so confident was she that she had not played it.

THE COMMITTEE on the geology of Rhode Island of the Providence Franklin Society has issued a valuable report on the geology of Rhode Island, including a useful bibliography of this subject, and setting forth briefly the various attempts made by the society to organize a thorough topographical and geological survey of the State. The committee was appointed in 1883, and we quote from its valuable report the following general remarks, which show the object of the work undertaken by the committee: "Our chief purpose has been to bring to the notice of the Franklin Society what has already been learned about the geology of Rhode Island. We have attempted little original investigation, but have tried to lay the foundations essential to future progress. The necessity for a collation of authorities is apparent to one who seeks to gain a clear idea of the geology of Rhode Island. Information is scattered through many publications. The Franklin Society endeavored to secure a new survey of the State in 1875–76, and again made an effort for a topographical survey in 1885–86; but thus far nothing has been accomplished. This report is published as the best contribution the society can make to the cause, — a step towards a complete survey; for a knowledge of what has already been learned is the proper foundation on which to build." It is to be hoped that the unceasing endeavors of the society to undertake a survey on a similar plan to that of Massachusetts, in co-operation with the United States Geological Survey, will be successful. In 1885 Governor Brown sent a message to the Assembly, commending such a plan, which involved two annual payments of three thousand dollars, but the Assembly did not act on it. The present publication, which is a valuable help to all students of the subject of the geology and geography of New England, we hope will help to show the necessity of undertaking a thorough survey.

IS THE RAINFALL INCREASING UPON THE PLAINS?

TO most of the inhabitants of that broad, billowy expanse which stretches from the Missouri to the Rocky Mountains, and from Canada to the Rio Grande, this question may seem unnecessary. It has so long been assumed by them as an axiom that the rainfall is increasing, that the opening of the question to discussion may appear like questioning the Copernican system. They have seen the frontier of settlement moving steadily westward, passing successively the limits set for it. Thirty years ago all the country west of the Missouri was considered as the 'Great American Desert,' in which, without irrigation, agriculture was an impossibility. But the stream of immigration has swept, with each succeeding year, farther and farther up the slope of the plains, driving the border of the desert before it. The 98th meridian was set as the boundary which the farmer could not pass, but now millions of acres are under cultivation beyond it; then the 100th meridian, but in Kansas and Nebraska the farms stretch scores of miles farther westward.

Progress has not, however, been uniform. Seasons of drought have checked it, and have depopulated temporarily large areas; but the settlers have returned to the charge, and have invariably won the day in the end.

To-day the cereals are being cultivated in Kansas, without irrigation, nearly to the west boundary of the State, in regions where the annual rainfall twenty years ago was less than twenty inches, — a region which at that time, as was generally agreed, could be rendered productive only by artificial watering. How has this been brought about? Have settlement and tree-planting induced greater rainfall, as is almost universally believed in this region, or are other causes involved?

Of course, if this westward extension of settlement has become

possible through an increase of rainfall, such increase must be of notable amount. The effect upon agriculture of a minute increase would be scarcely appreciable, and certainly would not suffice to produce the effects claimed for it, or to explain the wide-spread belief in this increase which is prevalent. In examining the rainfall records, we are, then, to look for substantial amounts of increase, — several inches annually. I would add that these records are now ample for testing this theory, and their testimony should be conclusive.

I find in this area twenty-six stations at which rainfall records have been kept for periods ranging from six to twenty-eight years, the total number of years of record being three hundred and ten. These stations are scattered widely over the area in question, from its eastern to its western border, and involve all stages of settlement. Now, if there has occurred an increase in the amount of rainfall, that of the later years of any series should, on the whole, be greater than that of the earlier years. I have therefore cut each of these series in the middle, and added up the rainfall of each half. These are presented in the following table, where the first column gives the names of the stations; the second, the number of years in the series; the third and fourth, the total rainfall in the first and second halves of each series respectively; and the fifth, the increase or decrease, the former being distinguished by the +, the latter by the — sign:—

Fort Leavenworth, Kan.	28	518	525	+ 7
Leavenworth, Kan.	18	366	362	− 4
Manhattan, Kan.	28	400	407	+ 7
Lawrence, Kan.	18	306	319	+ 13
Fort Larned, Kan.	12	131	119	− 12
Topeka, Kan.	8	117	140	+ 23
Dodge City, Kan.	12	105	149	+ 44
Wallace, Kan.	6	50	59	+ 9
Atchison, Kan.	8	189	156	− 33
Baxter Springs, Kan.	6	130	102	− 28
Burlingame, Kan.	6	84	96	+ 12
Council Grove, Kan.	8	178	141	− 37
Fort Hays, Kan.	6	55	79	+ 24
Fort Riley, Kan.	16	185	214	+ 29
Olathe, Kan.	8	201	194	− 7
Belleville, Kan.	14	184	218	+ 34
De Soto, Neb.	6	109	80	− 29
Fort McPherson, Neb.	6	58	52	− 6
North Platte, Neb.	12	108	120	+ 12
Omaha, Neb.	18	319	337	+ 18
Omaha Agency, Neb.	6	75	78	+ 3
Yankton, Dak.	12	170	178	+ 8
Bismarck, Dak.	12	140	102	− 38
Fort Benson, Mont.	6	34	40	+ 6
Cheyenne, Wyo.	16	84	98	+ 14
Denver, Col.	14	112	103	− 9

It will be seen at once that the individual results are contradictory in a high degree; those from sixteen stations showing an increase, while ten stations show a decrease. These contradictions, which are due to the irregularity of the rainfall may, however, be in a measure eliminated by combining the results, under the supposition that the change, if any, has been a progressive one. Under this assumption, the sum of the earlier halves of the different series should be less than that of the later halves. Adding them together, it is found that the aggregate rainfall at all the stations was, in the first half of the series, 4,408 inches, and in the second half, 4,468 inches; showing that there has apparently taken place an increase of 60 inches in the total amount of rainfall at all these stations in a total of 310 years, or, to put it in another form, there has fallen in each year of the second half of these series 0.4 of an inch more rain than in the first half. It is unnecessary to add that this is not the sort of increase for which we were searching, as an increase of but a fraction of an inch certainly could not produce the results which are claimed. An examination of the seasonal distribution of the rainfall shows that that also has undergone no material change since settlement began in this region. We may therefore dismiss as baseless the popular idea of an increase in rainfall, either annual or during the growing season, and look elsewhere for an explanation of the phenomena of settlement which the plains present.

The early explorers, of the time of Fremont and the Pacific Railroad surveys, based their judgments of the capabilities of the country for agriculture upon the character of the natural products, the absence of trees, the presence only of sparse, hardy grasses, the cactus, and the yucca. Their judgment was a mistaken one, as events have amply proved.

Since their time physical geographers have set arbitrary limits to safe farming without irrigation, basing their reasoning upon the known rainfall of the region, and that supposed to be required for the average farm product. Subsequent experience has shown that a much smaller quantity of rain is essential than was supposed. To my mind, there is little more to be said. If it be found, that, with an annual rainfall during the growing season not greater than ten inches, farming can be carried on successfully, the only question remaining is, how the mistake could have been made of supposing that it required a greater amount.

There is no doubt that cultivation adds greatly to the economy of the rainfall. The surface of the plains in an uncultivated condition is mainly bare, hard ground, but slightly protected by its covering of grasses. From such a surface the rain flows off freely, and an unusually large proportion of it finds its way into the streams, while a correspondingly small proportion sinks into the ground. The farmer, with plough and harrow, changes all this, and retains in the soil most of the rainfall. From year to year the supply in the soil increases, so that the subsoil becomes in time a reservoir from which the surface soil may draw in times of drought. Furthermore, the scanty vegetation offers little protection against evaporation, which is excessive upon the barren plains; but the ampler mantle which cultivation spreads over the soil prevents its moisture from disappearing in the atmosphere with so great rapidity.

How much farther westward into the arid region can the farmer push? This is a very important question, affecting the value of millions of acres of land; for, if this land can be cultivated only by the aid of irrigation, nine-tenths of eastern Montana, Wyoming, Colorado, and New Mexico, together with western Dakota, Nebraska, and Texas, must be given over to the cattle-men in perpetuity, as the streams are entirely insufficient for irrigation. A conclusive and satisfactory answer can be given only by the farmer

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WASHINGTON SCIENTIFIC NEWS.

A Novel Way of Forming Alloys. — The Constituents of Sugar. — Rainfall in the Arid Regions. — Irish Myths and Folk-Tales. — Examining Fats.

The Formation of Alloys.

THE following is an abstract of a note read before the Philosophical Society by William Hallock, of the United States Geological Survey, Feb. 18, 1888:—

In the *Berichte der chemischen Gesellschaft*, vol. xv. 1882, pp. 595–597, W. Spring describes the formation of alloys by submitting the filings of the constituent metals to high pressure, without appreciable rise in temperature. Wood's alloy of cadmium, tin, lead, and bismuth he produced by mixing proper weights of the filings of these metals, and subjecting them to a pressure of 7,000 atmospheres. The block thus obtained was again filed up, and subjected to the same pressure.

In this way a block of metal was produced which possessed the physical properties of ordinary Wood's alloy, formed by melting the mixed constituents.

W. Chandler Roberts repeated this experiment (*Chemical News*, vol. xlv. 1882, p. 231), and verified Mr. Spring's results.

In seeking an explanation of the above phenomenon satisfactory