

## RAIN-MAKING IN TEXAS.

IN NATURE of September 17 (p. 473), Mr. H. F. Blanford has discussed at considerable length the rain-making experiments in Texas, on the basis of such information as was attainable from newspaper reports. Inasmuch as these telegraphic reports have not only been inadequate, but also frequently inaccurate and misleading, the writer, who was the meteorologist of the Expedition, is led to give the following brief summary of the experiments and their results.

The experiments, which have been quite independent of the direction or patronage of the Weather Bureau, have been carried on by the Hon. R. G. Dyrenforth, Special Agent appointed by the Department of Agriculture. The plan of exploding oxy-hydrogen balloons was adopted as one of the principal methods to be employed, and several months were spent in preparing the necessary materials and apparatus. Preliminary experiments made in Washington demonstrated that a tremendous concussion could be produced by the explosion of balloons 10 feet in diameter, filled with a mixture of hydrogen and oxygen in the ratio of two to one. In addition to the explosion of balloons, preparations were made to fire sticks of dynamite carried up in the air by kites, and to explode rackarock (an explosive consisting of three parts of potassium chlorate to one part of nitrobenzol) and dynamite on the ground.

With materials for carrying out these three lines of experiment, the party went to an isolated ranch twenty-three miles north-west of Midland, Texas (lat.  $32^{\circ} 14'$ , long.  $102^{\circ} 12'$ ). The inauguration of the experiments attracted great attention throughout the whole south-western section of the country, and, locally, people went from all the surrounding counties to witness the operations. Actual trial in the field soon developed the fact that the preparations for the balloon experiments were entirely inadequate. Accidents occurred to the furnaces for generating the gas, which took much time to repair, windy weather prevented the filling of the balloons, and a combination of other sources of delay rendered this line of experiment a practical failure. One or two balloons were exploded on several days, but these were too few in number and too infrequent to serve the purpose of an adequate experiment. Similarly it was found impossible with the small available force to operate the kites to advantage, and in windy weather they were quite unmanageable; so that, although, in all, quite a number of dynamite sticks were fired in the air in this way, yet as a line of effective experiment this also proved a failure. The only explosions that were made on a scale even approximately commensurate with the requirements were those of rackarock, and it may be stated that all the effective operations essential at Midland can be duplicated in every essential particular with 1500 pounds of rackarock together with 500 feet of wire and a small portable dynamo.

The first rain that occurred after the party reached Midland began shortly after noon on August 10, and continued at intervals until evening. The amount of rainfall was not measured, but it was stated in the language of the country to be a good "grass rain." The writer, who was *en route* to Midland, met similar sharp showers in the latter part of the afternoon near Sweetwater, 100 miles to the eastward. On the preceding evening some preliminary explosions had been made, but only on a small scale, and no result was anticipated. In the telegraphic despatch that was sent reporting the rainfall, no causative action was claimed—in fact, such action was explicitly disclaimed in the telegraphic report, which stated "we do not think the explosions actually produced the storm, as they were not on a large enough scale. The preliminary trial was made simply to test the efficiency of the special blasting powder." The firing,

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which was not over half-a-dozen blasts, was, then, simply a preliminary trial of material, and not in any sense an experiment to produce rain.

On August 16, 17, 18, and 20, cloudy weather very largely prevailed, and numerous thunderstorms were seen on the horizon that did not visit the ranch. On each of these days blasts of rackarock and of dynamite were fired while heavy cumulus or dense storm-clouds were in the field. In several instances, when a dense threatening cloud was overhead, a sharp detonating explosion of rackarock or of dynamite was followed at an interval of 30 to 40 seconds by a spatter of rain, or, if it was already sprinkling, the blast was followed by a very noticeable increase of the drops. This interesting result occurred a sufficient number of times to indicate that the phenomenon was a real effect of the explosions. On none of these days, however, was the amount of rainfall appreciable, except on the 18th, when it was two-hundredths ( $0.02$ ) of an inch. The 18th opened cloudy, and old settlers predicted rain for the afternoon, whether the experiments should be made or not. To what extent, therefore, the explosions that were made were influential in producing the  $0.02$  inch that fell is obviously very difficult to determine, and as an evidence of the efficacy of the explosions it is practically valueless.

The next explosions were on the evening of August 21, when 156 pounds of rackarock were fired in 14 blasts. During the night a genuine norther came on, the wind blew from the north, the barograph curve rose rapidly, the temperature fell rapidly, and during the next forenoon a fine mist prevailed. This change of weather was quite extraordinary and unexpected, and with its accompanying mist was attributed to the heavy firing of the evening previous; but the norther had been on its way for several days, and the fine mist was evidently due to the uplifting by the cold north wind of the warm moist air of the plains. At numerous points in the State where the air was more humid a heavy rainfall occurred.

The last experiment, which in magnitude was the greatest of all, took place on the evening of August 25, after the writer had departed. The conditions were thought to be extremely unfavourable for rain, and the party was advised to wait for a more propitious occasion. The firing, however, was carried on until 11 p.m., when the party retired for the night. It is reported that "at 3 a.m. the heavy rolling of thunder disturbed the sleepers, heavy banks of clouds were seen advancing, almost constantly lighted by most brilliant lightning. An hour later the rain began to fall in torrents on the ranch, and did not cease till 8 a.m." Unfortunately, records of the amount of rainfall have not yet been received, but I am informed, by a gentleman who was present, that "it was nothing but a sprinkle." Further light is thrown on this rainfall by the weather map for 8 p.m. eastern time, of August 25. Rainfall is shown in New Mexico to the north-west of Midland, Texas, and the forecast officer made the following prediction: "For Eastern Texas, generally fair, except *local showers* on the extreme south-east coast and the north-west." Here we have an official prediction made in Washington City of probable showers over the district in which the experimenters were operating, and for the very night in which the thunderstorm followed the last of the explosions to produce rain.

In view of these facts, it is scarcely necessary for me to state that these experiments have not afforded any scientific standing to the theory that rain-storms can be produced by concussions. But, if the adherents of the theory maintain that "no experiment has been tried that is worthy of the name, and that no results ought to be looked for," it will be difficult to take opposite ground.

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