A SYSTEM OF LOCAL WARNINGS AGAINST TORNADOES.

I HAVE lately examined with some care the excellent compilation by Sergeant Finley of the signal-service, 'Characteristics of six hundred tornadoes,' with reference to the question of devising a simple apparatus for saving human life.

Saving property seems to be out of the question, as no structure can withstand the force of the tornado-wind. Life may be saved by recourse to underground shelters, cellars, etc., such as actually have been built in many places for this end.

Two facts may be quoted from the work named, — 1°. Three hundred and forty-seven out of three hundred and ninety-three tornadoes (that is eighty-eight per cent) originated between the west and the south-south-west points; 2°. The average velocity of progression was about one mile in two minutes.

From what we already know of the atmospheric conditions necessary to the production of tornadoes, it seems probable that in the future it may be practicable for the general weather service in Washington to send out warnings a day in advance to large regions of country within which tornadoes are likely to occur. These warnings would necessarily be of a very general nature. They would simply state that the conditions were such on two sides of a large region (like the state of Wisconsin, for example) as to make it probable that tornadoes would occur somewhere inside that region within twenty-four hours. The local weather services of states like Ohio and Iowa could, perhaps, make these predictions a little more specific; but there is no prospect whatever that warnings of any particular tornado can be given in the immediate future. It can be said, that, within a district five hundred miles square, tornadoes are likely to occur within twenty-four hours, and such a warning would be of value; but it does not seem to be probable that it can be said that a particular thirty miles square of this region is in particular danger. Under these circumstances, it is of interest and importance to inquire whether some efficient method of local warnings cannot be devised. If five minutes' warning could have been given at any of the late tornadoes, many lives might have been saved. If each household could be warned by the continuous ringing of a bell, for example, that a wind of destructive force (say, seventy miles per hour and upwards) was approaching, and that five minutes were available in which to seek shelter, this would be well worth doing.

A wind of seventy miles an hour is sufficient to blow down chimneys and to unroof houses, unless they are well built. Ordinary trees will not stand under it. The pressure on a square foot is in the neighborhood of fifty pounds. There might be occasions where seventy miles would be the maximum wind-velocity; and the person who had taken refuge in the cellar might be inclined, after the gust had blown over, to find fault with the indicator which had predicted a tornado, when only a violent gale occurred. But such storms do not occur as often as once a year; and it would seem that one could afford to be frightened as frequently as this for the sake of immunity from an occasional tornado, which might be following in the track of such a violent gale.

I have found that it is practicable to erect, at a moderate expense (less than five hundred dollars), an apparatus which would give from three to five minutes' warning to all the inhabitants of a small town, by the firing of a cannon, for instance; and in addition, and without any increased expense, this apparatus could ring a bell in every house. The additional expense to each house would be less than ten dollars, the cost of maintenance would be less than a hundred dollars a year, and the work could be done by any intelligent person. The system, for a small town, would be something like the following: suppose a circle described about the town with a radius of from two to two and one-half miles. The only serious danger from tornadoes is to be feared from the part of this circle between the west point and the south-south-west point. Along the circumference of this circle, between the south-south-west and west points, run a line of single telegraph-wire on twenty posts to the mile, and from the west point bring the wire into the town, letting it end at the telegraph-office. It is grounded at each end of the line, and at the telegraph-office it is connected with a battery, which sends a constant current over the line. Within the town, connection is made in various houses with magnets. Each magnet holds a detent, which prevents a bell from being rung by the action of a cheap clock-work governed by a coiled spring. If the circuit is broken anywhere in the line, each bell begins to ring, and continues to sound till its spring is run down; for four or five minutes, for example. A cannon could be fired by a simple device, which would warn persons in the fields, etc., to seek shelter. In a large town the circuit might end in one of the engine-houses

of the fire-department, and ring a bell there. This would be the signal for the man on watch to repeat the warnings simultaneously through as many local circuits as desirable.

It remains to indicate the way in which the circuit is to be broken by the wind. The circle of telegraph-poles from the south-south-west to the west points would contain about fifty poles. On every one of these the wire would run first to an insulator, then to an iron horizontal axis screwed into the side of the post. On this axis a piece of board one foot square can revolve freely. An iron rod projects below this board, and from the lower end of it a small wire goes to a pin in the telegraph-pole. This pin is connected by wire to a second insulator. From this the line goes to the next pole, and so on. The circuit ordinarily passes to the first insulator, thence to the iron rod, thence down the iron rod to the thin wire, through the pin and to the second insulator, and so to the next telegraph-pole. The thin wire is a necessary part of the circuit. It is so made that it will break when the pressure of the wind on the square board is fifty pounds. The apparatus for each post is tested practically before it is set up. This can be done at any time in a simple manner. Whenever any single one of these boards is subjected to the pressure of fifty pounds, its wire will be ruptured, and the circuit will be broken, thus sending the necessary warning along the whole line.

I have made one such indicator, which is connected with a small bell in this observatory. The wire is arranged so that it breaks at a wind-velocity of about ten miles per hour, and it works in a perfectly successful manner. The extension of the system for the protection of a small town is a simple matter. For a large city a more expensive system would have to be provided, as the wires between poles should be carried underground to protect them from the chance of disturbance.

I need not enlarge on the details of the scheme, since they can be worked out by any one who is at all familiar with electrical constructions. I believe that I have considered all the practical difficulties, and that there are none of any importance. It is a very simple matter to provide for the inspection of the line, bells, etc., so as not to interfere with the working of the system, and so that false alarms will not be given.

The point I wish to emphasize is, that a practical and cheap system of local warnings can be had, and that it ought to be considered by those who live in districts subject to tornadoes. The particular manner in which the above-described device is to be employed is a question to be settled by the particular circumstances of each case. I have only described the simplest and cheapest form, but this has been proved by trial to be efficient.

I may just mention, that, by employing a spring balance to hold the board in position, it is possible to provide an indicator which will break the circuit at any desired velocity of wind.

To any one who has seen the effects of a tornado, or even to one who has simply read that in this year alone several hundreds of lives have been lost from their violence, it will appear that the question of erecting systems for local warnings ought to be seriously considered by persons living in exposed regions.

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THE WILD TRIBES OF LUZON.

When the Malays took possession of the Philippines, they either found there, or were soon joined by, Japanese, Chinese, Siamese, Javanese, and Dyaks from Borneo and Celebes, all waging war against the Papuans, who had gone there from the south-east, if they were not aborigines. Under these circumstances, we should expect to find the present natives a very mixed race, who have received different names, according to the predominating characters in each locality. There is no unanimity of opinion among those who have studied the people in their own homes, and I think it impossible wholly to unravel the tangled skein of races. The following is what, from my observation and reading, I think a fair approximation to the truth.

The name of *Igorrote* has been applied to almost every wild tribe except the Negritos. I agree with Dr. Semper that it should be restricted to those of northern Luzon, who are hybrids of Japanese and Chinese with the Indians, differing somewhat in features and customs, according to the principal admixture.

In the Igorrote the stature is small, with well-developed form, indicating great strength with little symmetry; color very dark; eyes oblique; hair long, and, in the women, combed in Chinese fashion; nose flat, lips thick, mouth large, and cheeks wide. Houses mere huts, on the ground or raised on posts, shaped like a beehive, with furniture of the rudest description, — arms, hatchets, lances, daggers, bows and arrows, frequently poisoned, of bamboo, and shields. Their presence would be accounted for as the descendants of the army of