MISCELLANEOUS.

THIS WONDERFUL CENTURY.

ALFRED RUSSELL WALLACE, who cooperated with Darwin in formulating the doctrine of the survival of the fittest, and who is conspicuous in the foremost rank of writers on natural history, may be accepted as an observer eminently qualified to review from the vantage-ground of science the procession of the passing century, and to record with understanding and with conscientiousness the achievements emblazoned on its banners.

The task he has set himself has been to trace, in compact and forcible sketches, the great material and intellectual results which especially distinguish the nineteenth century from any or all of its predecessors, and to show how fundamental is the change they have effected in our civilization; for the passing century must be held to constitute the beginning of a new era of human progress, and in order to estimate its full importance and its grandeur we must compare it, he declares, not with any preceding century, or even with the last millennium, but with the whole historic period—perhaps even with the whole period that has elapsed since the Stone Age.

"The one step in material progress that seems to be really comparable in importance with several of the steps we have just made, was when fire first became the servant and the friend of man." Without fire there could have been neither a bronze nor an iron age, and without these there could have been no effective tools or weapons—with the long succession of mechanical discoveries and refinements that have come of them. Without fire there could be no rudiment even of chemistry; with our fire much of the earth's surface would be uninhabitable by man, and much of what is now wholesome food would be impossible to him.

By the magic of fire we are led to the locomotive and the ocean-steamer, those overcoming glories of our century. An ancient Greek or Roman, Egyptian or Assyrian, could travel as rapidly and as comfortably as could an Englishman, down to the latter part of the eighteenth century. It was mainly a question of roads; and until the beginning of the nineteenth century, English roads were commonly far inferior to those of the Romans. It is not improbable that during the occupation of Britain by the Romans, the journey from London to York could have been made in less time than in 1750.

And so of ocean-steamers. Five hundred years ago Vasco de Gama sailed from Portugal, round the Cape of Good Hope, to India, and in the next century Columbus crossed the Atlantic, in its widest part, to the West Indies and Mexico. From that time sailing-ships were gradually improved, until they culminated in formidable frigates of war, and the swift clipper ships of the China and California trades. But during all that period of development there was no change in principle, and the grandest three-decker on the full-rigged clipper was but an inevitable growth from the rudest canoe that ever a primeval savage paddled.

Now we have the bicycle, and the principle is old enough. But in the last century it would not have been possible to construct a first-class bicycle at less cost than seven or eight hundred dollars. And all this wonderful advance in the means and methods of locomotion has been achieved within the memory of a man of threescore and ten.

Then came the sewing-machine, which at first was for embroidering only. About 1790, one was made for stitching shoes; a crocheting-machine was patented in 1834, one for rough basting somewhat later; but it was not until 1846 that the first effective lock-stitch machine was produced by Elias Howe of Massachusetts.

Then followed the typewriter, and the wonderful harvesting-machine—reaping, threshing, winnowing, and sacking, ready for

the granary or the market. And these were all conceived in the first half, and brought to perfection in the last half, of this wonderful century. Nor must we forget the Jacquard loom, the revolver, the machine-gun, the iron ship, and the screw-propeller.

The invention of writing superseded the slow functions of the messenger, the herald, the ambassador. Henceforth the progress of communication was inseparable from that of locomotion.

Even with good roads and mail-coaches the actual time taken in the despatch of a letter to a distant place was hardly less than that required by the runner or the mounted courier. With railways and steamships came activity, regularity, economy to the postal service—Rowland Hill and penny postage, and the money order.

It was not until 1837 that the efforts of many workers, striving to the same end, overcame the practical difficulties, and the electric telegraph was set up. The first submarine line was laid from Dover to Calais in 1851; and in 1856 a company was formed to lay a cable across the Atlantic; another, more successful, was completed in 1866, and now all the seas are electrically bridged.

And then came the telephone, with its vibrating disks, culminating in a line of a thousand miles, bringing the ear of Chicago to the lips of New York. At Budapest they have a telephonic newspaper:

"At certain hours throughout the day a good reader is employed to send definite classes of news along the wires, which are laid to subscribers' houses and offices, so that each person may have the particular items he desires, without the delay of printing and circulating in successive editions. The news is supplied to subscribers at little more than the cost of a daily paper."

In such facilities of communication the advance made in the present century is not only amazingly greater, but is even more solemnly impressive in its bearing upon human destiny than all that was achieved in the whole preceding period of history.

About 1827, Mr. John Walker, a chemist of Stockton-on-Tees, invented friction matches, by dipping splints of wood in chlorate of potash and sulfur, mixed with gum; phosphorus was added in 1834, and by 1840 these matches became so cheap as to popularly supersede the old flint and steel; and thus, by a new departure, only sixty years ago, the means of procuring fire, which had remained unchanged over the whole world, were transformed by the magic of a chemist's simple trick.

In the illuminants—beginning with the resinous torches, when link-boys were as common in the streets of London as are the match-peddlers now—we have done some wonderful conjuring. The three modes of obtaining illumination for domestic purposes—the torch, the candle, the lamp—remained unchanged in principle, and but slightly improved, throughout the whole historic period, and down to the end of the eighteenth century; even the Argand lamp did not come into common use until 1830, and candles were used in lighthouses in the first decade of the nineteenth.

A few houses and factories were lighted with gas at the very end of the last century, but its first application to general purposes was in 1813, when Westminster bridge was illuminated.

And now we are examining the larynx with an incandescent (electric) lamp, and even letting it down into the stomach. Says the writer again:

"Whether we consider the novelty of the principles involved, or the ingenuity displayed in their application, we can not estimate this advance at less than that effected during the whole preceding period of human history—from that very remote epoch when fire was first taken into the service of mankind, down to the time of men now living among us."

Photography has come to the aid of the arts and sciences in a way that would have been utterly inconceivable a century ago. It has equipped the meteorologist, the physicist, the biologist, with self-registering instruments of extreme delicacy, and enables them to preserve accurate records of the most fleeting natural phenomena. In the field of astronomy its achievements are astounding; by the aid of photography stars are shown which no telescope that has been, or that probably ever will be constructed, can bring within the field of human vision.

And the photographer's dream has been fulfilled—to obtain pictures which shall reproduce all the colors of nature, without the intervention of the artist's manipulation. Professor Lippmann, of Paris, in a lecture before the Royal Society in 1896, fully described his method and exhibited many beautiful specimens. The effects are fascinating, the only fault being that the colors are more brilliant than in nature, just as they are when viewed in the camera itself.

And the Roentgen ray, that most recent of all the discoveries in connection with light and photography, discloses curious secrets. This new form of radiant energy opens up so many possibilities, both as to is own nature and as to the illimitable field of research in the properties and powers of the mysterious ether, that it forms a fitting and dramatic climax to the scientific discoveries of the century.

The overwhelming importance of the small things, even of the despised things, of our world has never, perhaps, been so impressively demonstrated as in the recent investigations into the beneficial influences, widespread and far-reaching, of atmospheric dust. Few of the fairy tales of science are more marvelous than these recent discoveries as to the important functions and the kaleidoscopic enchantments of dust, in the economy of nature.

To the earlier physicists the blue of sky and ocean seemed but the natural color of pure air and water, so pale as not to be visible when but small quantities were observed, and only seen through vast depths of atmosphere or organic water. We quote again:

"But this theory did not explain the familiar facts of the gorgeous tints revealed at sunrise and sunset—not only in the atmosphere and on the clouds near the horizon, but equally resplendent when the invisible sun shines upon Alpine peaks and snow-fields. . . . Every one has seen the floating dust in a sunbeam when sunshine enters a partially darkened room; but it is not commonly known that if there were absolutely no dust in the air, the path of the sunbeam would be totally black and invisible, while if only a very little dust were present in minute particles, the air would be as blue as a summer sky. . . . So, when the great luminary has passed from our direct vision, his light shines on the under sides of all the clouds and air strata of different densities; a new and more brilliant light flushes the Western sky, and a display of gorgeous ever-changing tints occurs, which is at once the delight of the beholder and the despair of the artist. And all this glory we owe to—dust!"

Thus, it is dust that gives us the pure blue of the empyrean, the glories of the sunrise and the sunset, and all the splendors that are the wonders of high mountain regions. Without dust the sky would appear absolutely black, and the stars would be visible at noonday. Half the beauties of the world would vanish; and diffused daylight, or skylight, that most equable, soothing, and useful of all illuminating agencies, would be no more. From this cause alone the world would be so changed that all vegetable and animal life would be developed in very different forms, and even our own organization must be modified for adjustment to such harsh and violent contrasts. It is barely twenty years since Coulier and Mascart in France, and John Aitken in England, demonstrated that to the presence of dust in the higher atmosphere we owe the formation of mists, clouds, and gentle rains, instead of waterspouts and destructive torrents.

The dawn of history disclosed to us the Arabic numerals; the fourteenth century gave us the mariner's compass; the fifteenth, the art of printing, and to the seventeenth century we owe the telescope. But this wonderful nineteenth century has brought us railways, steamships, electric telegraphs, the telephone, lucifer-matches, gas and electric illumination, photography, the Roentgen ray, spectrum analysis, anesthetics, and antiseptic surgery. And the demon of greed, and the plunder of the earth, and the arming of the nations!