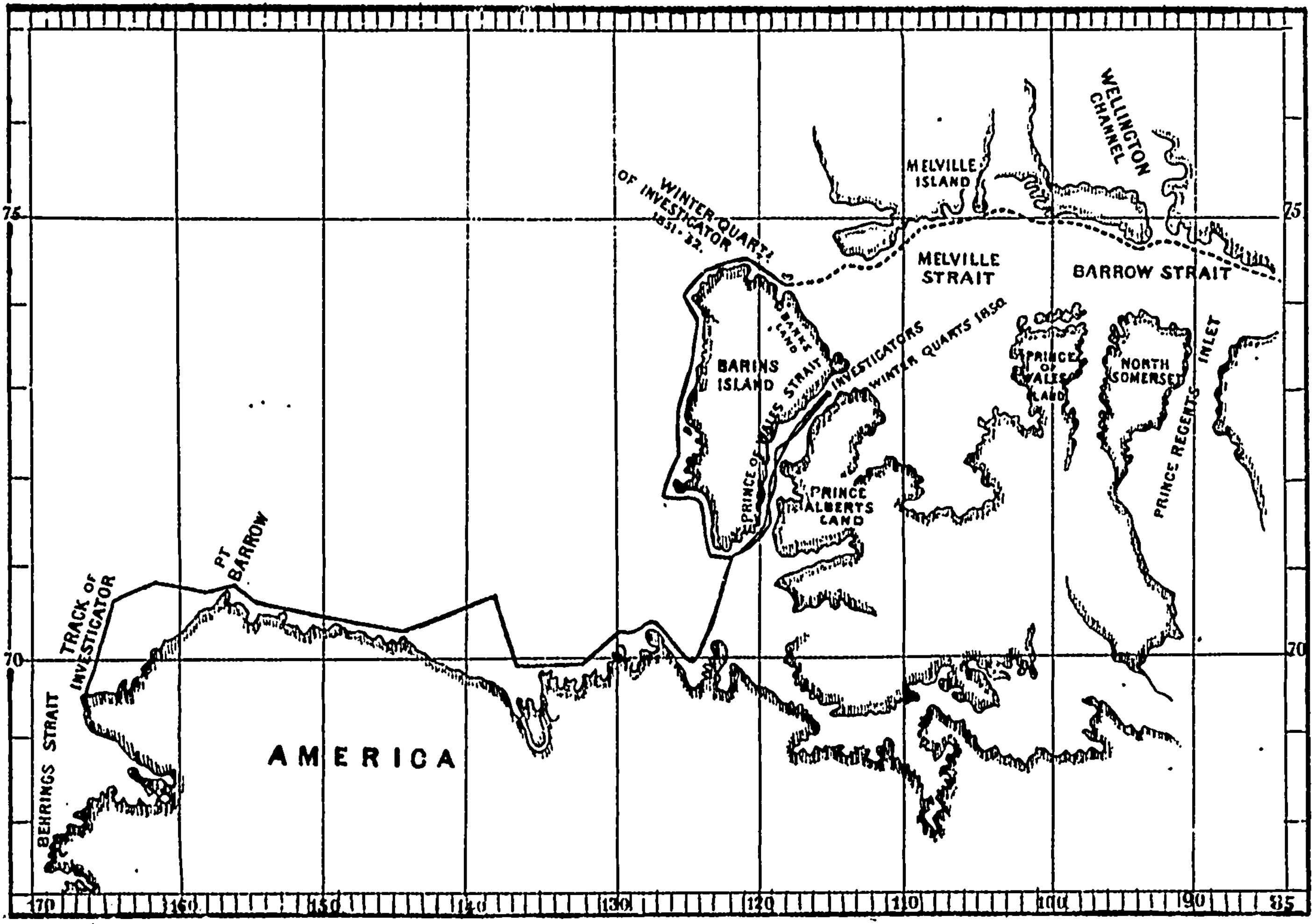
WELLINGTON CHANNEL
MELVILLE ISLAND
WINTER QUARTS OF INVESTIGATOR 1851-52.
MELVILLE STRAIT
BARROW STRAIT
BANKS LAND
BARINS ISLAND
PRINCE OF WALES STRAIT
INVESTIGATORS WINTER QUARTS 1850
PRINCE OF WALES LAND
NORTH SOMERSET
PRINCE REGENTS INLET
PRINCE ALBERTS LAND
PT BARROW
TRACK OF INVESTIGATOR
BEHRINGS STRAIT
AMERICA
75
70
170
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110
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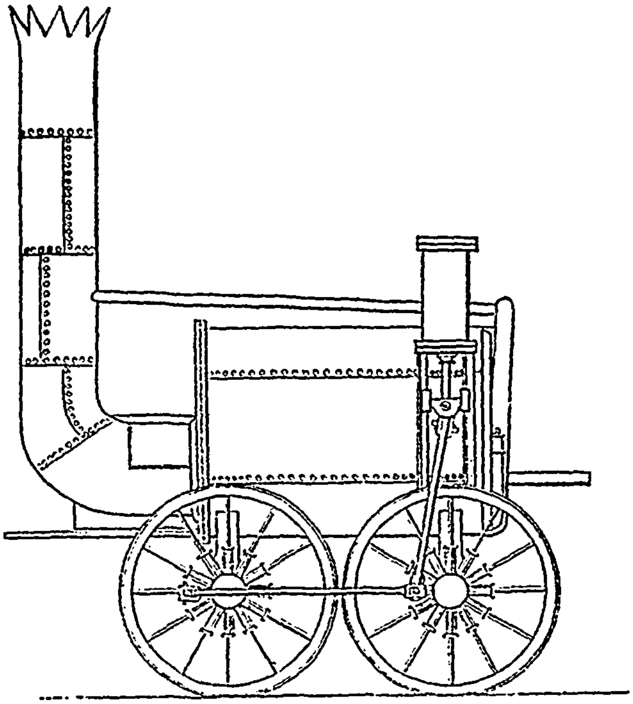
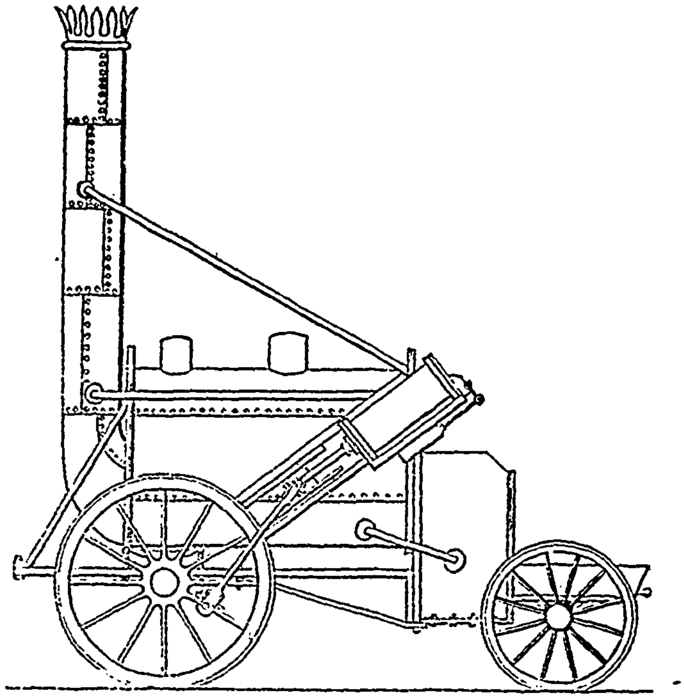
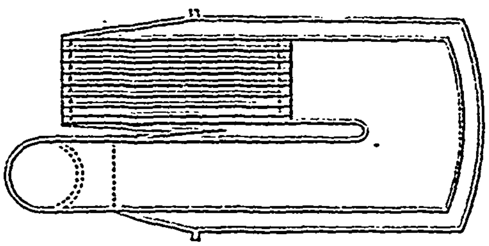
90
85



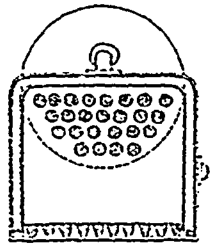
"THE SANSPAREIL"—By Hackworth.



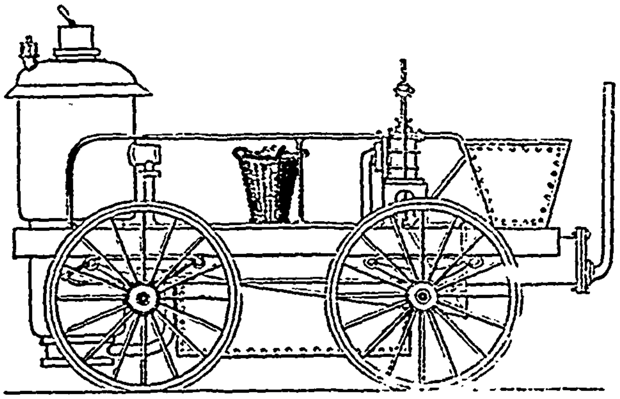
"THE ROCKET"—By Stephenson.



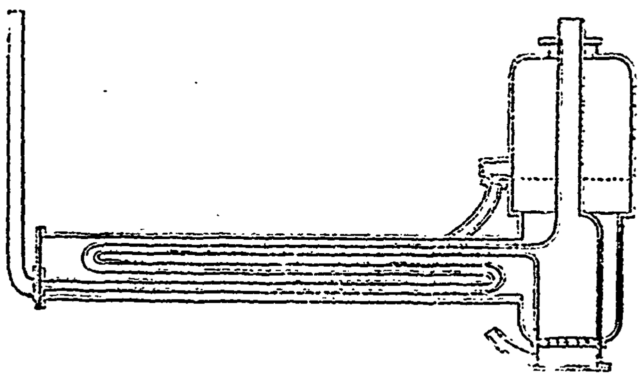
Plan of the Boiler of the "Sanspareil."



Section through the Boiler of the "Rocket."



"THE NOVELTY"—By Ericson.



Section through the Boiler of the "Novelty."

The Canadian Journal.

TORONTO, NOVEMBER, 1853.

The Annual Report of the Superintendent of the Coast Survey, [U. S.] Showing the Progress of that work during the year 1851, pp. 538, accompanied by a Quarto Volume, Map and Chart.

This Report with its voluminous appendices, contains a variety of official documents relating to the Coast Survey of the United States, many of which have no interest for the general reader, while others will attract universal attention. The extracts from the report of Professor Agassiz, to the Superintendent of the Coast Survey, on the examination of the Florida reefs, keys and coast, contain most interesting information respecting the formation, progress and decline of the coral reefs. A portion of these we subjoin.

On page 227 of the 1st Volume of this Journal will be found the elaborate report of George Mathiot, Electrotypist, on the electrotyping operations of the United States Coast Survey, which forms the concluding portions of this important and elaborate work.

MODE OF FORMATION OF THE CORAL REEF.

The reefs of Florida as they have been described in the foregoing sketch of the topography of that state, and, indeed, the separate parts of each of these reefs, in their extensive range from north-east to south-west, present such varieties as will afford, when judiciously combined, a complete history of the whole process of their formation.

Here we have groups of living corals, beginning to expand at considerable depth, and forming isolated, disconnected patches, the first rudiments, as it were, of an extensive new reef. There we have a continuous range of similar corals in unbroken continuity for miles, or even hundreds of miles, rising at unequal heights nearly to the surface.

Here and there a few heads or large patches, or even extensive flats of corals, reach the level of low water mark, and may occasionally be seen above the surface of the waters, when the sea is more agitated than by the simple action of the tides. In other places coral sands or loose fragments of corals, larger or smaller boulders, detached from lower parts of the living reef, are thrown upon its dying summits, and there form accumulations of solid material, rising permanently above low water mark; collected sometimes in such quantities and at such heights as to remain dry, stretching their naked heads above high water.

In other places these accumulations of loose, dead materials have entirely covered the once living corals, as far as the eye can reach into the depth of the ocean: no sign of life is left, except perhaps here and there an isolated bunch of some of those species of corals which naturally grow scattered, or of those other organisms which congregate around or upon coral reefs; but the increase of the reef by the natural growth of the reef-building corals is at an end. Again, in other places, by the further accumulation of such loose materials, and the peculiar mode of aggregation which results from the action of the sea upon them, and which will be more fully explained hereafter, extensive islands are formed, ranging in the direction of the main land, which support them. Elsewhere we may find the whole extent of the reef thus covered, while, after a still more protracted accumulation, perhaps becomes united with some continental shore.

Now, it must be obvious, that from a comparison of so many separate stages of the growth of a coral reef, a correct insight may be obtained into the process of its formation; and, indeed, in thus alluding to the different localities which came under our own observation, we have already given a general history of its progress, which we now proceed to illustrate more in detail.

We would, however, first remark, that the extraordinary varieties which exist in the natural condition of different parts of the same reef, or of different reefs, when compared with each other, fully explain the discrepancies between the reports which have been obtained, respecting the reefs of Florida, prior to our investigations.

It had been stated that the reefs consisted solely of living corals; and, indeed, this report is true of the outer reef, which is called by all the inhabitants of Florida "*the reef*," *par excellence*, and is unfounded only with regard to those few islands which rise above the surface of the sea at Sand Key and the Sambos. Others, who had noticed only the larger accumulations of coral fragments which occur on the shores of some islands forming part of the Florida reef, had reported the islands to be formed of coral rocks; while some who had, perhaps, observed the extensive excavations made around Key West, have told us only of the existence of oolitic and compact rocks, almost destitute of corals or other remains of animal life; and from still other localities comes the opinion, that the rocks consist of nothing but more or less disintegrated shells, cemented together.

ON ANIMAL LIFE.

* * * * * * * * * *

The fullness and variety of animal life is particularly obvious within the boundaries of coral fields, the natural limits assigned to the growth of these animals being those in which animals of other classes range in greater profusion, and the coral reefs themselves also affording very favourable circumstances for the display of numerous living forms. Hence the extraordinary assemblage of all classes of animals upon the reef, where, besides those particular kinds of corals which contribute largely to its formation, we find upon it, or on the foundation from which it rises, a great variety of other corals, which, though too insignificant in size to take a conspicuous part in building up these extensive accumulations of organic lime-work, add none the less their small share in the work, contributing especially to fill up the vacant spaces left by the more rapid and durable growth of the larger kinds. They are to the giants of the reef what the more slender parts are to the lords of the forest, adding the elegance and delicacy of slighter forms to the strength, power, and durability of their loftier companions.

But besides the stony corals, we find in the reef a great variety of soft polyps, either attached to the surface of dead corals, dead shells, or of the naked rocks, or boring into the coral sand and mud.

* * * * * * * * * *

Such are different species of arca, the date-fish among the mollusca, and many worms, especially serpula among articulates, the agency of which in the formation of the keys will be described hereafter. All these animals and plants contribute, more or less, to augment the mass of solid materials which is accumulating upon the reef, and increase its size. Not only are the hard parts of shells, echinoderms, worms, or their broken fragments, heaped among the detritus of the corals, but occasionally even the bones of fishes and turtles, which are very numerous along the reef, may be found in the coral formations.

The decaying soft parts of all these animals undoubtedly have their influence upon the chemical process, by which the limestone particles of their solid frame are cemented together, in the formation of compact rocks. Upon this point we may expect further information from Professor Horsford, who is now submitting to chemical analysis all the variety of rocks and the solid stems of the different corals obtained in Florida.

Respecting the relations of the solid and soft parts of the living coral, and their mode of growth, we would refer to a paper of ours now in press, to appear in the next volume of the Smithsonian Contributions to Knowledge.

CORAL REEFS.

After examining a growing coral reef, so full of life, so fresh in appearance, so free from heterogeneous materials, in which the corals adhere so firmly to the ground, or if they rise near the surface, seem to defy the violence of the ocean, standing uninjured amid the heaviest breakers, an observer cannot but wonder why in the next reef, the summit of which begins to rise above the level of the water, the scene is so completely changed. Huge fragments of corals, large stems, broken at their base, gigantic boulders, like hemispheres of Porites and Macandrina, lie scattered about in the greatest confusion; flung pell mell among the fragments of more delicate forms, and heaped upon those vigorous madrepores which reach the surface of the sea.

The question at once arises, how is it that even the stoutest corals, resting with broad base upon the ground, and doubly secure from their spreading proportions, become so easily a prey to the action of the same sea which they met shortly before with such effectual resistance? The solution of this enigma is to be found in the mode of growth of the corals themselves. Living in communities, death begins first at the base or centre of the group, while the surface or tips still continue to grow, so that it resembles a dying centennial tree, rotten at the heart, but still apparently green and flourishing without, till the first heavy gale of wind snaps the hollow trunk, and betrays its decay. Again, innumerable boring animals establish themselves in the lifeless stem, piercing holes in all directions into its interior like so many augurs, dissolving its solid connexion with the ground, and even penetrating far into the living portion of these compact communities. The number of these boring animals is quite incredible, and they belong to different families of the animal kingdom: among the most active and powerful we would mention the date fish, lithodomus, several saxicava, petricola, arca, and many worms, of which the serpula is the largest and most destructive, inasmuch as it extends constantly through the living part of the coral stems, especially in macandrina.

On the loose basis of a macandrina measuring less than two feet in diameter, we have counted not less than fifty holes of the date-fish—some large enough to admit a finger—besides hundreds of small holes made by worms.

But however efficient these boring animals may be in preparing the coral stems for decay, there is yet another agent, perhaps still more destructive. We allude to the minute boring-sponges which penetrate them in all directions, until they appear at last completely rotten throughout. * * * * *

The experiments of the late Sears C. Walker* on the subject of galvanic wave time, furnish very valuable information on the propagation of the electric current. The results arrived at by that distinguished astronomer are given below:—

1. That the average of all our experiments to that time (1850) indicates a velocity of propagation of the inducing waves of 15,400 miles per second in the iron wires of a telegraph line.

2. That the velocity of propagation through the ground appears to be less than two-thirds of the velocity in the iron wires.

These conclusions were in accordance with the independent results of the researches of Dr. B. A. Gould and Mr. Karl Culman, previously read, and since published in the proceedings of the American Association for the Advancement of Science, at their meeting in New Haven in August, 1850.

There have been three independent series of observations for the value of wave-time, made since October last, 1850. The first experiment was repeated on several nights, between Seaton Station and Portsmouth, Va. The distance on the iron wires is 268 miles, and the distance through the ground is 180 miles. The clock station excess, in the electrotonic readings, by a mass of 221 measures, was +0s.024, while the computed excess for the assumed velocity of 15,400 miles per second, in the iron wires, was +0s.035. The difference between theory and computation is, theory greater by +0s.011.

The second experiment was made from Charleston, S. C., to Augusta, Ga., in the winter of 1851. The distance on the iron wire from Columbia (where the Charleston end went to the

* At a meeting of the officers and members of the U. S. Coast Survey, the Superintendent, Professor A. D. Bache, delivered the following sketch of Mr. Walker's scientific attainments:—

We have met to pay our tribute of respect and feeling to one of our most distinguished and valued associates, Sears C. Walker, Esq., whose failing health for more than a year past has kept us in anxiety and fear for the result which has now come. Mr. Walker was attacked by bilious fever some weeks since; and though his mind was clear, his physical strength was not adequate to resist the effects of the disease.

The services which Mr. Walker has rendered to the coast survey are known in a general way to most of those whom I address. He had made the largest collection of American observations of moon culminations and occultations ever made in the country, and prepared to discuss them thoroughly for longitudes, and to bring them to bear, as far as applicable, by the geodetic results of the coast survey, upon the longitude of a central point. The magnitude of this labor would have appalled an ordinary mind. He knew that by perseverance it could be accomplished. During this discussion he reached the conclusion that the longitudes from moon culminations could not be reconciled with those from occultations, and that the theory must be re-examined for an explanation. His published reports show the successive steps of his investigation, which was not completed at the time of his decease. In the midst of it, the new, attractive, and important subject of determining differences of longitude by the telegraph was committed to him, and he threw all his zeal and knowledge into the solution of this problem, and brought it to the successful condition in which it now is. He early saw the impossibility of reading a near result by merely repeating the transmission and reception of signals, beats of a clock or chronometer, and that the beats sent and received must be of time-keepers regulated to different times—as, for example, mean solar and sidereal, and seized all the consequences flowing from this principle. The telegraphing of transits of stars was original with him.

He soon became satisfied of the necessity for graphic registry of the time results, and invited the co-operation of Mr. Saxton, of Mr. Bond, of Prof. Mitchell, and of Dr. Locke in the solution. With him originated the application of this method to the registry of time observations for general astronomical purposes, now developed by so many ingenious modes, and known as the "American Method." His researches on galvanic wave-time, growing out of these experiments for difference of longitude, are by far the most valuable contributions yet made to this branch of science. In this subject alone Mr. Walker accomplished a most remarkable five years' work; but this was only a part of what his mind found there to do, and, aside from this and labors of daily and nightly routine in computing and observing, he accomplished a work—investigation of the orbit and computation of an ephemeris of Neptune—which of itself would have given him an undying reputation. I cannot in this place describe how the training of a life was obtained which led to these brilliant results for our work, and for American science; nor can I trust myself now in an analysis of the mind and heart of this friend for many years. I have faintly pencilled his doings while closely connected with our work, shadowing merely his claims to our admiration, respect and gratitude.—*Republic, Feb* 8.

ground) to Augusta, was 301 miles, and from Augusta to Savannah 146 miles, making the total connextion through the iron wire, 447 miles, and the distance through the ground from Columbia to Savannah, 135 miles. The clock was at Savannah. The arbitrary signals were given at Charleston. The observed clock excess was by 59 measures +0s.056. The computed wave-time, for the above assumed velocity, was 0s.058, leaving a difference of +0s.002.

The third experiment was made at Cincinnati, on the 9th of May last, on the occasion of the meeting of the American Association for the advancement of science. The telegraph line was composed of 840 miles of iron wire, without ground connexion. The distances were as follows: from Cincinnati to Steubenville, 295 miles; thence to Cincinnati the same; thence to Louisville 125 miles, thence to Cincinnati the same. The personal clock signals were given by Mr. Stager, chief operator, at Cincinnati. In the first experiment the arbitrary signals were given by the operator at Steubenville, and recorded at Steubenville, and also on the two registers at Cincinnati, on opposite branches of the line. These registers, I will call, respectively, Stager and Jones; Stager being the register for the clock station. The observed excesses were, for Steubenville arbitrary signals, as follows:

Stager—Steubenville........+0s.040 by 31 measures.
Stager—Jones..............÷0s.039 by 31 "

Again, for the Jones arbitrary signals, on the Stager clock scale, we found:

Stager—Steubenville.......—0s.004 by 39 measures.
Stager—Jones..............+0s.050 by 226 "

The direction of the current from the platinum to the zinc, through the junction wires, was from Stager to Steubenville, thence to Jones, thence round by Louisville to Stager.

This is the first experiment made by the Coast Survey on a telegraph line of iron wire exclusively without ground connection.

The first conclusion to be drawn from this experiment is, that the excesses of the clock station readings in the experiments heretofore made, have not been owing to the fact that a part of the galvanic current has been made through the ground, since they are here found to be as great for the dimension of the line as in former experiments with the partial ground connexions.

This experiment was made with a long circuit of iron wire without ground connexion. It confirms the general conclusion respecting the value of wave time. It gives a new field for the discussion of the physical question, whether the wave is propagated round in one direction and only affects the magnets as it reaches them in succession in this direction, or whether the wave travels by the shortest direction from one magnet to another, without reference to the character of the pole. Our experiments with lines composed partly of ground and partly of iron wire stretched on poles, led to the preference of the latter view of the subject. The experiments at Cincinnati in 1851 raises some doubt on this conclusion; it was made with a single battery at Cincinnati and with 840 miles of wire all in the air. The work of this night was not as complete as I could have desired, I must therefore wait till similar experiments are made under more favourable circumstances before attempting a further examination of the question.

The Arctic Expeditions.*

The return of the Phœnix steamer,—which, our readers will remember, was despatched with a transport to convey stores to Sir E. Belcher's searching squadron—puts us in possession of intelligence from the Arctic regions of a most interesting and at the same time a very painful nature.

The leading feature of interest lies in the fact, that the problem of a passage for ships between the Atlantic and the Pacific Oceans, north of the American continent—a problem which has engaged the enterprise of maritime nations, and particularly of our own, for upwards of three centuries—has been finally solved. Capt. M'Clure has succeeded in navigating his ship from Behring's Strait, in the west, to within about sixty miles of Melville Straits,—and was, according to the last accounts, waiting only for the disruption of the ice to pass through those straits and return by the eastern outlet to England.—The problem had long since been stript of all that portion of its interest which was reflected on it from the field of commercial speculation; but its solution, after ages of such perilous adventure as that by which it has been sought, is a great scientific triumph,—and adds fresh glory to the old and famous flag of England.

In lieu of the commercial interest which once attached to this long *vexata quæstio*, none better than the readers of the *Athenæum* know how melancholy an interest of another kind has attached to the late years of adventure in these ice-bound seas:—and the painful part of the intelligence now brought home has reference to that latter subject of anxiety and suspense. The secret of ages has been yielded up at last, we have too much reason to fear, on heavy terms. The proud satisfaction which Englishmen must feel at the discovery of a North-west—or rather, North-east—passage, is clouded by the sad fact, that the intrepid conquerors of this mysterious route have come on no traces of Franklin and his unfortunate companions.

When on the eve of sailing, Capt. M'Clure emphatically declared that he would find Sir John Franklin and Capt. Crozier,—or make the North-west passage. He has, geographically speaking, redeemed the latter part of this pledge:—but the fate of those gallant Commanders and their crews is hidden yet amid the dark and labyrinthine ice-paths of the Arctic seas. The scientific secret of centuries has been wrenched at last from the Spirit of the North;—but the human secret which in these latter days the heart of more nations than our own has so yearned to solve, he guards yet, in spite of all questioning, in some one of his drear and inaccessible caves.

It will be remembered by those who have followed the history of the Arctic Expeditions in our columns, that Capt. M'Clure was first lieutenant of Sir James Ross's ship Enterprise,—and having been promoted, volunteered for the second Expedition by way of Behring's Strait. He was appointed to the command of the Investigator, under Capt. Collinson, of the Enterprise; and proceeded with that officer to Behring's Strait in the early part of 1850. Capt. Collinson having failed to penetrate the pack ice, parted from Capt. McClure, and sailed to Hong Kong, where he wintered; but the latter, notwithstanding a signal of recall from Capt. Kellett of the Herald, who was the chief officer on that station, dashed onwards with a bold determination to force a passage to the north-east,—taking on himself all the responsibility of disobeying orders. Fortunately, his daring has been crowned with success; and it is not a little singular that Captain Kellett, who was the last person seen by Capt McClure when he entered the ice on the west,—should have been the person to rescue him at the expiration of three years on the side of Melville Island on the east.

We learn from Capt. M'Clure's despatches—which are very voluminous—that on the 5th of August (1850) he rounded Point Barrow, the north-eastern extremity of Behring's Strait,—and then bore to the east, keeping near the shore. On the 9th, he passed the mouth of the Colville; and on the 11th, a notice was deposited upon Jones's Island, which was found thickly

* Athenæum.

strewed with drift wood. Here communication was held with the natives,—one of whom had a gun with the name of Barnet, and the date 1840 on the lock; and tobacco was bartered for salmon and ducks. The thievish propensity of these natives alluded to by other explorers is amply confirmed by Captain M'Clure.—Struggling on through narrow leads of water, the Pelly Islands, at the mouth of the Mackenzie, were reached on the 21st of August,—and Point Warren, near Cape Bathurst, on the 24th. Here a circumstance occurred which we should be glad to know admitted of satisfactory explanation.

It appears, that on attempting to land at the above point, two natives waved the adventurers off with threatening gestures. It was with much difficulty that they were pacified; and then, they related, that all their tribe but the chief and his sick son had fled on seeing the ship,—alleging as a reason that they feared the Investigator had come to revenge the death of a white man whom they had murdered some time ago. They proceeded to relate (through the medium of the interpreter on board the Investigator), that some white men had come thither in a boat, and that they built themselves a house and lived there. At last the natives murdered one; and the others escaped—they knew not where. The murdered man was, they said, buried in a spot which they pointed out. Capt. M'Clure adds, that he was prevented from examining this grave in consequence of a thick fog which obliged him to return to his ship. It is matter of most serious regret that the truth of this story was not inquired into. The history of the Adam Beck fabrication of the murder of white men by Esquimaux, and the well known habit of these latter to exaggerate and deceive, render it expedient, no doubt, to receive all accounts from them with much doubt:—but here the means of verification were apparently at hand. *Primâ facie*, it is hardly likely that natives would volunteer a statement to the officer so self-criminatory as the above, unless it rested on grounds of truth. And here we may mention, that a correspondent has drawn our attention to an extract of a letter seemingly bearing on the above story, which we published in our columns in 1848, (No. 1094, p. 1029,) and which excited considerable interest at the time. The letter in question was received by the Admiralty from Chief Factor Macpherson. It is dated March 1, 1848, and contains this passage:—"There is a report from Peel's River, that the Esquimaux saw two large boats (*query* ships?) to the east of the Mackenzie River full of white men; and they, the Esquimaux, showed knifes, files, &c., to the Peel's River Indians, which they had received from these white men. Could these have been Franklin or Rae?" To the latter query, we may at once answer, that it could not have been Rae; on the other hand, the locality referred to by the Esquimaux is precisely that in which a boat party endeavouring to return by the Mackenzie would have encamped. It agrees, too, exactly with the Esquimaux story told to Captain McClure; and we must hold, that steps should have been taken by him to investigate the matter. We trust, that the Hudson's Bay Company, who always evinced a desire to aid the searching cause, will lead a helping hand towards completing this inquiry.

Continuing his course to the east along the coast, the water being very shallow, but admitting of safe navigation, Cape Perry was reached by Captain McClure on the 6th of September.—From this position high land was observed to the E. N. E. This was taken possession of, and named Baring Island. Two days after this discovery, land was observed to the N. N. E., which was named Prince Albert Land. This is continuous with Wollaston and Victoria Lands, and extends north to 73° 21′ lat. and 112° 48′ west long. Here, Capt. McClure was very near Rae's discoveries in 1851. The Investigator was now navigated through a channel, called Prince of Wales Strait, dividing Baring Island from Prince Albert Land. This strait runs to the north-east, and was a most promising course for reaching the sea south of Melville Island. In the centre of the strait a number of islands were discovered,—to which the name of the Princess Royal was given; and a depot was made on one of them of three months' provisions for sixty-six men, with a boat and ammunition. Sailing up the strait, the Expedition progressed very favorably until the 11th of September,—when the ship was beset and drifted with the ice, narrowly escaping destruction several times, until the 8th of October. On that day she became firmly fixed. The position at this time, as will be seen by the accompanying chart, was not far from the northern extremity of the strait. Here she was frozen in,—and remained stationary during the winter.—Parties were sent out to explore; and it was soon ascertained that the channel opened into Barrow Strait. This established the existence of a North-West passage! Had the sea remained open a few days more, the Expedition would have made the passage,—not only in one season, but in the short space of little more than two months and a half.

The summer of 1851 was now anxiously awaited; but meanwhile advantage was taken of the spring to explore the coasts to the north-east and south-east in the direction of Bank's Land, and Wollaston Land. In the course of their exploration, tribes of Esquimaux were met with who had evidently never seen white men before. They were quiet and inoffensive. Several musk oxen were shot on Prince Albert Land,—and proved a welcome addition to the supplies of the party.

On the 14th of July (1851) the ice opened without any pressure and the Investigator was again fairly afloat. Great exertions were made to pass through the strait; but, after many attempts, the progress of the Expedition was completely arrested on the 16th of August by strong north-east winds driving large masses of ice to the southward. At this date the party were in latitude 73° 32′ and longitude 115° 32′. Thus baffled, Capt. McClure boldly resolved on running to the southward of Baring Island, and sailing up northward along its western side. This, after many delays, and after surmounting formidable obstacles, he accomplished. Eventually he succeeded in reaching the north side of Baring Island on the 24th of September. Had open water existed to the east, the rest of the passage might have been easily performed this way; for Barrow's Strait lay before them,—the navigation of which from their position to Lancaster Sound, was known to be practicable. Unhappily, however, on the night of the above day the Investigator was frozen up; and to the date of Capt. McClure's last despatch, (April 10, 1853,) she had not been liberated. Her position is 74° 6′ north lat. and 117° 54′ west long. Captain McClure describes the locality as being excellent:—well protected from ice by the projection of a reef which throws it clear of the ship 600 yards.

In April, (1852) a party crossed the ice to Melville Island,—and deposited a document there giving an account of their proceedings and of the position of the Investigator. This was, happily discovered by Captain Kellett's officers—only a few days before Captain McClure had made arrangements for deserting his frozen-up ship. Immediate steps were taken to communicate with the party in their ice-prison!—and the excitement of the meeting between Lieut. Pim, who was appointed for the service by Captain Kellett, and the officers of the Investigator, they only will understand who can imagine the horrors of such a prison, and the long, dreary and dreadful paths by which the prisoners were about to make their desperate attempt at escape from it.—It would, we hope, be precipitate to predict that the Investigator will not be liberated from her icy bonds this year; but we have high Arctic authority for stating, that, looking to the enormous quantity of ice this summer in Barrow's Strait, and in the seas south and west of Melville Island, it is not likely that the ship has yet been moved. The perils of Arctic navigation in the vicinity of the pole receive a frightful expression in the following calm, gallant instruction given by Capt. McClure:—"It is my intention he says if possible, to return to England this season (1852) touching at Melville Island and Port Leopold; but should we not be again heard of, in all probability we shall have been carried into the polar pack, or to the westward of Melville Island,—in either of which events, to attempt to send succour would only be to increase the evil, as any ship that enters the Polar pack must be inevitably crushed. Therefore, a depot of provision or a ship at Winter Harbour is the best and only certainty for the safety of the surviving crew." This, as will be seen by the date, was written last year:—and precisely the steps recommended by him have been taken for the discovery and rescue of Capt. McClure and his companions.

With respect to the navigation of the North-west Passage, which is a subject of great geographical interest, Capt. McClure observes:—"a ship stands no chance of getting to the westward by entering the Polar sea—the water along shore being very narrow and wind contrary, and the pack impenetrable; but through the Prince of Wales Strait, and by keeping along the American coast, I conceive it practicable. Drift-wood is in great abundance upon the east coast of the Prince of Wales Strait, and on the American shore,—also much game. The hills in this vicinity abound in rein-deer and hares, which remain the entire winter:—we have procured upwards of 4,000 lb." From the observations which were made, it appears that the set of the currents is decidedly to the eastward.—"At one time," says Capt. McClure, "we found the set as much as two knots in a perfect calm,—and that the flood-tide sets from the westward, we have ascertained beyond a doubt, as the opportunities afforded during our detention along the western shore gave ample proof." This is one of the important facts of Capt. McClure's enterprise,—and established the propriety of making any future attempt at a passage which might be required from the side of Behring Straits.

Up to April 1852, the health of the crew of the Investigator was excellent; but during the past winter scurvy manifested itself—and it was fatal to three individuals in the spring.

According to the last accounts from Captain Kellett, it appears that he had sent his surgeon to report upon the health of the crew of the Investigator; and had given instructions that should there not be among them twenty men who were sufficiently well and would volunteer to remain another winter, Capt. McClure would desert his vessel. This step, indeed, seems to be contemplated; for Capt. Inglefield states, that the Intrepid steam tender was expected at Beechy Island with the crew,—and Sir E. Belcher had ordered the North Star to be prepared on her arrival to proceed to England and to leave the Intrepid at Beechy Island in her place.

We turn now to Sir E. Belcher's despatches:—which, if not so interesting in a geographical point of view as those of Captain McClure, yet contain many important features. At the head of these may be placed,—first, the existence of a polar sea, which Sir Edward feels convinced is now placed beyond a doubt:—and secondly, the discovery of what we would gladly hope may be further traces of Franklin.

When Capt. Inglefield left Beechy Island last year, he brought home the intelligence that Sir E. Belcher had gone up Wellington Channel, and had been absent three weeks. It now appears that he reached Cape Becher to the north-east, near which in lat. 76° 52′ and long. 97° West, a locality was found for winter quarters. Apprehensive that the open season was fast approaching to a close, preparations were made for boat and sledge explorations to the northward:—and these were commenced on the 23rd of August. On the 25th, when rounding a point where the coast suddenly turns to the eastward, the remains of several well built Esquimaux houses were discovered. "They were," says Sir E. Belcher, "not simply circles of small stones, but two lines of well laid wall in excavated ground, filled in between by about two feet of fine gravel, well paved, and withal, presenting the appearance of great care,—more, indeed, than I am willing to attribute to the rude inhabitants or migratory Esquimaux—Bones of deer, wolves, seals, &c., numerous. Coal found." There is no mention of any search having been made for a record,—though in all probability this was not neglected; yet the absence of any cairn would seem to render it unlikely that a document existed. It will be observed that Sir E. Belcher does not hazard an opinion as to whether these huts were built by Franklin's party or not:—but if not by Esquimaux, it would be difficult to arrive at any other conclusion.

The explorations of Sir Edward and his officers led to the discovery of various lands,—to the most extensive of which the name of North Cornwall was given,—and of several islands washed by a sea open to the north, which, as we have stated, Sir E. Belcher regards as the Polar basin. Sir Edward gave the name of Victoria Archipelago to a group of islands in 78° 10′ N. lat.; and the easternmost, forming the channel to Jones's Strait, which communicates with the Polar Sea, he named "North Kent." It is important to add, that as early as the 20th of May he found the sea open in the latitude of Jones's Strait. His words are—"Polar sea as far as the eye could range." He also states that the tides were most apparent, setting from east to west.

Thus, it is due to Capt. Penny to record, tnat although many of his headlands and visual bearings are erroneous, as might be expected,—yet, the fine open water which he described as existing to the north of Wellington Channel is a reality, and his views of its connection with the Polar basin are borne out by Sir E. Belcher's observations.

In the spring of this year, a very extensive sledge journey was made by Commander Richards and Lieut. Osborne. They started from their winter quarters in Wellington Channel,—and bearing to the north-west in the first instance, afterwards struck south, and, crossing Melville Island, reached the winter quarters of the Resolute at Dealy Island. Here they communicated with Capt. Kellett:—from whom they heard the pleasing intelligence of the safety of the Investigator. By this exploration, which was extended over a period of ninety-seven days, the shores of the eastern side of the Hecla and Griper Gulf were examined; and returning up Byam Martin Channel, its connection with the Polar basin was ascertained.

The last despatches from Sir E. Belcher, dated "H.M.S. Assistance, on return to Beechy Island, about ten miles east of Cape Beecher, July 26, 1853," inform us, that his ships were liberated from the ice on the 14th of July,—and that his future proceedings will be determined by the nature of the despatches that he may find at Beechy Island. He strongly advocates the immediate return to England of the Investigator's crew; not conceiving it desirable that any further expense or risk should be incurred in waiting for the possible disruption of the ice. The probability of Capt. Collinson having followed Capt. M'Clure's track renders it expedient that a ship should be stationed at Melville Island,—and Capt. Kellett will in all probability be ordered to remain there.

Sir E. Belcher lays so much stress on the existence of an open Polar sea, that we are surprised that he does not state his intention of boldly entering it with his well-appointed ship and steam tender. Such a course would be warranted by his instructions, and at the same time be in harmony with his well-established spirit of enterprise.

It now only remains to notice Capt. Inglefield's despatches.

Having to tow the Breadalbane transport ship, his passage across Melville Bay was a difficult and tedious operation. Seldom during any part of the open season has so much ice been seen as was observed during this year. When in the middle of the bay, scarcely any water was visible from the mast-head,—and the Phoenix had already sustained so much damage from the pressure of the ice, as to render it necessary to shift the screw. On the 8th of August the Expedition arrived at Beechy Island; but so late was the season, that no water was seen from Cape Riley the day before. The ice was too abundant and hummocky to admit the possibility of landing the stores on Beechy Island;—and accordingly Cape Riley was selected for that purpose.

It became now an object of great importance to communicate with Sir E. Belcher,—and Capt. Inglefield resolved on being himself the bearer of Sir Edward's despatches. With this view, he started in his whale-boat, with a month's provisions, on the 10th of August,—leaving orders, in case of any unforeseen casualty preventing his return to the Phoenix by the time the transport was cleared, to run no risk of the ships being caught for the winter, but to proceed to England without him.

Wellington Channel was full of ice,—and so rough with large cracks and pools, that it defied sledging excepting with a strong party. An attempt was made to carry a small punt over the ice; but this proving ineffectual, Capt. Inglefield determined on proceeding by land with an officer and two men to Cape Rescue. Each man carried a blanket, a bag, and a fortnight's provisions. The Cape was reached, with much exertion, on the 13th of August; but further progress was arrested by open water. At this juncture, a notice was found stating that Capt. Pullen had returned to his ship after having communicated with Sir E. Belcher.

Having deposited duplicates of their despatches in the cairn, the party commenced their return to Beechy Island:—which was reached five days after their departure,—they having during this time travelled 120 miles. It was in a second attempt to convey the original despatches to Sir E. Belcher that one of the saddest episodes recorded in these last Arctic papers occurred. The gallant Lieut. Bellot, who, it will be remembered, accompanied Capt. Inglefield in the Phoenix—here lost his life. He had been sent by Capt. Pullen on the above duty:—having volunteered his services. A heavy gale having suddenly sprung up, he and two of his men were driven from the shore on a floe; and while reconnoitering from the top of a hummock of this floe in search of the means of escape for himself and his party, he was precipitated by a violent gust of wind into a deep crack in the ice, and there perished by drowning. Quite aware of his imminent danger, we are informed than in the face of death, he expressed his satisfaction that he was engaged in the performance of an important duty. His two companions were saved; and after driving about on the floe for thirty hours without food, they were enabled to regain their ship, bringing back the despatches in safety. Lieut. Bellot had won the friendship and esteem of all the officers on board the Phoenix. His loss will be deeply lamented here,—as doubtless it will be in the native service to which he was an honour. He had made a great number of magnetic and other observations, which will be placed in the hands of Col. Sabine for publication. He was at all times foremost in the offer of his services for any difficult or dangerous undertaking. Indeed, he sacrificed his life to a sense of duty. We are glad to learn that there is a design of erecting some testimonial commemorative of the loss of this excellent and able young officer. Such a step will, we feel sure, be duly appreciated by the French Government:—particularly if it should receive the countenance and support of our Admiralty. A meeting of the Royal Geographical Society will shortly be convened to take into consideration the best means of testifying the sympathy of the British public.

Shortly after Captain Inglefield's return to his ship, he had the misfortune to witness the total destruction of the Breadalbane transport. This event happened in the middle of the night of the 21st of August. The ice had been in motion for some days,—causing the greatest uneasiness respecting the safety of the vessels. At length a nip which the Phoenix resisted, proved too powerful for the less strongly constructed Breadalbane; and in less than fifteen minutes after she was struck she disappeared in thirty fathoms of water,—giving the people on board barely time to save themselves. Fortunately, nearly all the Government stores had been landed.—Another episode this, illustrating the terrible accidents of these seas which keep the dark secret of Sir John Franklin and his crews! The catastrophe shows, how important it is that ships should be efficiently strengthened for Arctic navigation. The voyage of the Investigator from Behring's Strait to her present position near Melville Island, is a proof how successfully a ship may be made to battle with thick-ribbed ice.

Captain Inglefield now resolved, in obedience to his instructions, on returning to England. With the crew of the lost Breadalbane in addition to his own, he left Beechy Island on the 24th of August; and after encountering many difficulties, he passed through Lancaster Sound, and into Baffin's Bay, rounding Cape Farewell on the 21st of September, and arriving off Thurso on the 4th of October.

It is worthy of mention that at Lievely, on the coast of Greenland, information was obtained of the existence of a coal mine twenty-six miles from the harbour, where coal may be obtained in large quantities. Captain Inglefield states that the Danes prefer it for burning in stoves to English coal.

Such are the principal and most interesting features of the despatches brought home by Captain Inglefield:—and under the head of geographical discovery, their importance cannot be overestimated.

It is of course quite possible that intelligence may yet arrive from Sir E. Belcher or Capt. Kellett, announcing either the discovery of our long-lost countrymen, or that of further tracks of their route and their possible whereabout. We have yet to learn the result of the explorations of Captain Kellett's officers; and we must not forget that Captain Collinson, who entered the ice at Behring's Strait in 1851, may by keeping a high north latitude strike their track. At the same time, although we have always leaned to the side of hope, bearing in mind the amazing quantity of animal life existing for the subsistence of the lost party in the Arctic regions, we cannot lose sight of the facts that the head waters of Wellington Channel have been partially explored without finding any vestige of Franklin or of his ships,—and that the explorations of Capt. M'Clure to the south-west of Melville Island prove beyond a doubt that they cannot be entangled in the ice in that locality. Our heart begins to faint, we must avow, beneath the burthen of hope deferred. Vast, however, as is the area which has now been swept by our searching ships, a much larger field yet remains unexamined. We cannot expect, after all that has been done, with the now faint chance of saving life if discovered,—that the Admiralty will continue the search until the ground shall be exhausted; but we would fain have the promising route by Nova Zembla tried, and the Siberian coast explored. Then, if the result of Sir E. Belcher's deliberations at Beechy Island shall be, his return to England, and consequent abandonment of the search for Franklin in the waters to the north of Wellington Channel, shall we be satisfied with the very imperfect search in that direction which still holds out the greatest promise? Surely, when we are told of an open sea in May, and of a Polar basin free from ice, its navigatian cannot be either difficult or tedious. Captain M'Clure has shown us that one north-west passage exists;

but we are much mistaken if other and more open passages far to the north, across the pole itself will not be found.

We may take this opportunity to state that one of the bottles picked up near the mouth of the Obi, on the Siberian coast, has lately arrived at the Admiralty. In a former number we stated that several of these bottles had been found in the above locality; and that the Admiralty had requested the Russian Government to forward one to England. It was, of course, hoped that it might prove to have belonged to Franklin's ships; but, having personally examined it,—we are sorry to say, that it is evidently of foreign manufacture, and not at all likely to have been furnished to Franklin's expedition. It is about the length of a soda water bottle—but more spherical; and is formed of very dark glass, nearly a quarter of an inch thick.

We are glad to hear that Commanders M'Clure and Inglefield have been promoted. To the latter we are indebted for a very clear chart showing Capt. M'Clure's track and discoveries;—from which the reduced map which accompanies this article has been copied.

The Daisy Anemone*.

All along this line of lime-stone rock, in almost every tide-pool and hollow that retains the sea-water, from the size of one's hand upward, we may at any time find colonies of the lovely Daisy Anemone, *Actinia bellis.* In the sunshine of a fair day they expand beautifully, and you may see them studding the face of the rock just beneath the surface, from the size of a shilling to that of a crown piece. Nothing seems easier than to secure them, but no sooner do the fingers touch them, than its beautifully circular disc begins to curl and pucker its margin, and to incase it in the form of a cup; if further annoyed, the rim of this cup contracts more and more, until it closes, and the animal becomes globose and much diminished, receding all the time from the assault, and retiring into the rock. Presently you discover that you can no longer touch it at all; it is shrunk to the bottom of its hole; the sharp irregular edges of which project and furnish a stony defence to the inhabitant. Nothing will do but the chisel, and that is by no means easy of appliance. It is rare that the position of the hole is such as to allow of both arms working with any ease; the rock is under water, and often, if your chisel is short, it is wholly immersed during the work, when every blow which the hammer strikes upon its head has to fall upon a stratum of water, which splashes forcibly into your eyes and over your clothes; the rock is very hard, and the chisel makes little impression; and what is frequently the greatest disappointment of all, the powdery *debris* produced by the bruising of the stone mingles with the water and presently makes it perfectly opaque, as if a quantity of powdered chalk had been mixed with it, so that you cannot see how to direct the blows, you cannot discern whether you have uncovered the *Actinia* or not, and frequently are obliged to give up the attempt when nearly accomplished, simply because you can neither see hole nor *Actinia*, and as to feeling in the pap-like mud that your implement has been making, it is out of the question. Supposing, however, that you have got on pretty well, that by making a current in the pool with your hand you have washed away the clouded water sufficiently to see the whereabouts, and that you perceive that another well-directed blow or two will split off the side of the cavity,—you have now to take care so to proportion the force that at last you may neither crush the animal with the chisel on the one hand, nor on the other drive it off so suddenly that it shall fall with the fragment to the bottom of the pool out of reach. However, we will suppose you have happily detached and secured your *Actinia* without injury. But how unlike its former self, when you were desirous of making its closer acquaintance, is it now! A little hard globose knob of flesh, not so big as a schoolboy's marble, is the creature that just now expanded to the sun's rays a lovely disk of variegated hues, with a diameter greater than that of a Spanish dollar. It is moreover covered with tenacious white slime, which exudes from it faster than you can clear it away; and altogether its appearance is any thing but inviting. You turn it into a jar of water, which of course you have with you when collecting living zoophytes; and thus bring it home, when you transfer it to a tumbler or other suitable vessel of clear sea-water freshly drawn. And here let us watch its changes;—which, however, will not be effected immediately; for it will not expand itself in all its original beauty until it has taken a fresh attachment for its base, which will not in all probability be for a day or two at least. The body or stem of *Actinia bellis* is more or less cylindrical generally; though subject to some change in this respect, for it is occasionally a little enlarged, as it approaches the disk; the sucking base is slightly larger than the diameter of the body, which in specimens of an inch and a half expanse, may be about half an inch. The length of the body varies much, according to the depth of the cavity in which the animal lives, for it must expand its disk at the surface. In the open water in a vase, when it appears at home, it may commonly be about an inch from the base to the expansion of the disk, but I have a beautiful specimen before my eye at this moment, which has stretched itself to a height of three inches, expanding at the extremity as usual: the thickness of the stem is in this case somewhat diminished.

* Extract from a Naturalist's rambles on the Devonshire Coast.—By Philip Henry Gosse.

Extraordinary Fishes from California, constituting a New Family, described by L. Agassiz.*

About fifteen months ago, I received a letter fom A. C. Jackson, Esq., soon after his return from San Francisco, California, informing me that while fishing in San Salita Bay, he had caught with the hook and line, a fish of the perch family, *containing living young.* The statement seemed so extraordinary, that though an outline of the specimen observed was enclosed, I suspected some mistake, and requested Mr. Jackson to furnish me further information upon what he had actually seen, and if possible specimens of the fish preserved in alcohol. To this enquiry I received the following answer:

"I regret much that the information which I sent you avails so little, without the actual specimens of the fish and young; these, however, I have already taken active measures to obtain, and trust before many months, to be able to send you at least specimens of the female, if not of the young. I should at the time I caught the fish have preserved them in alcohol, but at that time I was attached to the Navy Yard commission, and was with my comrades industriously prosecuting the examination of the vicinity of San Salita, as to its adaptiveness for a navy yard, and could not leave for San Francisco without suspending the work, and the means for preserving the fish could not be otherwise procured. This explains the apparent culpable indifference which allowed me to omit preserving the specimens. I have sent directions to California to have caught for me several of the fish, and if at the present time, (September 16th, 1852,) the females were pregnant (which is not probable) to take from one the bag containing the young, and put mother and young into the jar of alcohol, and to put several other females untouched into the jar also. These specimens will by direction and examination, even if they be not pregnant, and if the jar contains no young, determine the truth and accuracy of the statement I made in my former letter on the subject. This fact, proved by these specimens, it will be

* Silliman's Journal, November.

very easy to obtain during the next spring and summer, specimens in all stages of pregnancy. I think, if I remain in the country, I can insure you a sufficiency of specimens to determine to your satisfaction, the true state of the affair, during the course of the next year. The fish I refer to, in my opinion, does not exist in very great numbers even in the waters of San Salita Bay, for the two which I caught on this occasion were the only ones which I fell in with, though I fished in the same place probably four times. There was a little peculiarity, perhaps, in the circumstance of my taking them as I did. I had previous to this time, tried my rod and line, as I mentioned before, four times, always with success as regards groupers, perch, &c., without a sight of the singular fish under consideration. A few days, perhaps a week, after the four trials, and on the 7th of June, I rose early in the morning, for the purpose of taking a mess of fish for breakfast, pulled to the usual place, baited with crabs, and commenced fishing, the wind blowing too strong for profitable angling: nevertheless, on the first and second casts, I fastened the two fishes, male and female, that I write about, and such were their liveliness and strength, that they endangered my slight trout rod. I however succeeded in bagging both, though in half an hour's subsequent work, I got not even a nibble from either this or any other species of fish. I determined to change the bait, to put upon my hook a portion of the fish already caught, and cut for that purpose into the largest of the two fish caught. I intended to take a piece from the thin part of the belly, when, what was my surprise to see coming from the opening thus made, a small live fish. This I at first supposed to be prey which this fish had swallowed, but on farther opening the fish, I was vastly astonished to find next to the back of the fish, and slightly attached to it, a long very light violet bag, so clear and so transparent, that I could already distinguish through it the shape, colour and formation of a multitude of small fish (all fac-similies of each other) with which it was well filled. I took it on board (we were occupying a small vessel which we had purchased for surveying purposes,) when I opened the bag, I took therefrom *eighteen* more of the young fish, precisely like in size, shape, and color, the first I had accidentally extracted. The mother was very large round her centre, and of a very dark brown color, approaching about the back and on the fins a black colour, and a remarkably vigourous fish. The young which I took from her were in shape, save as to rotundity, perfect miniatures of their mother, formed like her, and of the same general proportions, except that the old one was (probably owing to her pregnancy) much broader and wider between the top of the dorsal and the ventral fins, in proportion to her length than the young were. As to colour, they were in all respects like the mother, though the shades were many degrees lighter. Indeed, they were in all respects like the mother and like each other, the same peculiar mouth, the same position and shape of the fins, and the same eyes and gills, and there cannot remain in the mind of any one who sees the fish in the same state that I did, a single doubt that these young were the offspring of the fish from whose body I took them, and that this species of fish gives birth to her young alive and perfectly formed, and adapted to seeking its own livelihood in the water. The number of young in the bag was nineteen. (I fear I mistated the number in my former letter,) and every one as brisk and lively and as much at home in a bucket of salt water, as if they had been for months accustomed to the water. The male fish that was caught was not quite as large as the female, either in length or circumference, and altogether a more slim fish. I think we may reasonably expect to receive the specimens by the first of December. But I can hardly hope to get satisfactory specimens of the fish as I found it with young well grown, before the return of the same season, viz., June. By that time I trust the facts will be fully decided, and the results, as important as they may be, fully appreciated."

In a subsequent letter (dated January 31, 1853.) Mr. Jackson informed me that he had requested Captain Case, U. S. N., who commanded a sloop of war in San Francisco, and who had also seen the fish, to supply my friend T. G. Cary, Jr., Esq., of San Francisco, with specimens of that fish, should he succeed in getting any. I wrote myself also to Mr. Cary, to be on the look out for this fish.

About a fortnight ago, I was informed by Mr. Cary, in a letter dated San Francisco, August 10, 1853, that after a search of several months he had at last succeeded in obtaining several specimens of this remarkable fish, three of which were sent by express, (which have reached me lately), while a larger supply was shipped round Cape Horn. After a careful examination of the specimens, I have satisfied myself of the complete accuracy of every statement contained in Mr. Jackson's letter of February, 1852, and I have since had the pleasure of ascertaining that there are two very distinct species of this remarkable type of fishes, among the specimens forwarded to me by Mr. Cary. I propose for them the generic name of Embiotoca, in allusion to its very peculiar mode of reproduction.

I feel some hesitation in assigning a family name to this type. It is probable that all its members will present the same peculiarity in their mode of reproduction, and that therefore the name *Embiotoca* may with perfect propriety be modified into *Embiotocoidæ*, as Didelphis has given its name to a numerous family, the *Didelphyidæ*, after having been for a long time simply a generic name. Should it however be found that other types of this family present various modifications in their vivaporous reproduction, for which the name *Embiotocoidæ* might be objectionable, I would propose to frame some family name from another structural peculiarity of these fishes, not yet observed in any others, the naked furrow-like space parallel to the base of the posterior dorsal fin, separating the scales which cover the base of the rays from those of the sides of the body and name it *Holconoti*.

The perseverance and attention with which Messrs. Jackson and Cary have for a considerable length of time been watching every opportunity to obtain the necessary materials for a scientific examination of these wonderful fishes, has induced me to commemorate the service they have thus rendered to zoology by inscribing with their names the two species now in my hands, and which may be seen in my museum in Cambridge, labelled *Emb. Jacksoni* and *Emb. Caryi*.

A country which furnishes such novelties in our days, bids fair to enrich science with many other unexpected facts, and what is emphatically true of California, is in some measure equally true of all our waters. This ought to stimulate to renewed exertions not only our naturalists, but all the lovers of nature and of science in this country.

FAMILY HOLCONOTI OR EMBIOTOCOIDÆ.

The general appearance of the fishes upon which this family is founded, is that of our larger species of Pomotis, or rather that of the broader types of Sparoids. Their body is compressed, oval, covered with scales of medium size. The scales are cycloid, in which respect they differ widely from those fishes they resemble most in external appearance. The opercular pieces are without spines or serratures. Branchiostegal rays six. The mouth is encircled by rather thick lips; the intermaxillaries forming by themselves the whole margin of the upper jaw. The intermaxillaries and upper maxillaries are slightly protractile. Teeth only upon the intermaxillaries, lower maxillaries and pharyngeals; none either upon the palatines or the vomer. In this respect, as well as in the absence of spines and serratures upon the opercular pieces, they differ much more from the Percoids than from the Sparoids; but the cycloid scales remove them at once from the latter, in which the scales present a very uniform ctenoid type. The thick lips might remind one of the Labroids, but the scales of the Embiotoca are neither elongated, nor provided with the characteristic branching tubes of that family.

One long dorsal fin, the anterior portion of which is supported by spinous rays, and the posterior by numerous articulated branching rays, which are sheathed at the base by two or three rows of scales, *separated from those of the body by a rather broad and deep scaleless furrow.* This last peculiarity has not yet been observed in any fish, as far as I know. There is indeed a distinct longitudinal space parallel to the soft portion of the dorsal, nearly of the width of a single row of scales, which is entirely naked and well defined, forming as it were, a furrow between the scales of the back, and those which rest against the base of the fin rays. Though protected in this way by a kind of sheath, the anterior part of the dorsal fin alone can be folded backwards and entirely concealed between these scales, as in many Sparoids; the posterior part only partially so. Moreover, the scales of the sheath are separated by a furrow from those of the back, only along the base of the soft part of the dorsal fin. The first rays of the anal fin are short, comparatively small and spinous. The base of this fin is strangely arched, and sheathed between scales, in the same manner as the dorsal; the spinous rays when folded back being more fully concealed in the sheath than the soft rays.

The ventrals are subthoracic as in the Sparoids, and provided with a strong spinous and five soft rays.

Four branchial arches, supporting four complete branchiæ with two rows of lamellæ in each. The opening behind the last arch is very small and entirely above the base of the pectoral fins. Pseudobranchia very large, and composed of sixteen or seventeen lamellæ. The alimentary canal is remarkably uniform in width for its whole length. It extends first on the left side as far back as the ventrals, turns forwards and upwards to the right, then follows the middle line along the *large air bladder*, to the second third of the abdominal cavity, then bends along the right side downward and slightly forwards almost to meet the first bend, when it turns backwards again, and ends in a straight course at the anus. The stomach can not at all be distinguished externally from the small intestine by its size and form. There are no *cœcal appendages at all* in any part of the intestine. The whole alimentary canal contained large numbers of shell fragments of small Mytili. The liver has two lobes, a short one on the left side, and a long one along the middle line of the body.

The female genital apparatus, in the state of pregnancy, consists of a large bag, the appearance of which in the living animal has been described by Mr. Jackson; upon the surface of it large vascular ramifications are seen, and it is subdivided internally into a number of distinct pouches, opening by wide slits into the lower part of the sack. This sack seems to be nothing but the widened lower end of the ovary, and the pouches within it to be formed by the folds of the ovary itself. In each of these pouches a young is wrapped up as in a sheet, and all are packed in the most economical manner as far as saving space is concerned, some having their head turned forwards, and others backwards. *This is therefore a normal ovarian gestation.* The external genital opening is situated behind the anus, upon the summit and in the centre of a conical protuberance formed by a powerful sphincter, kept in its place by two strong transverse muscles attached to the abdominal walls. The number of young contained in this sack seems to vary. Mr. Jackson counted nineteen; I have seen only eight or nine in the specimens sent by Mr. Cary, but since these were open when received, it is possible that some had been taken out. However, their size is most remarkable in proportion to the mother. In a specimen of Emb. Jacksoni, $10\frac{1}{2}$ inches long, and $4\frac{1}{2}$ high, the young were nearly three inches long and one inch high; and in an Emb. Caryi, eight inches long, and $3\frac{1}{4}$ high, the young were $2\frac{3}{4}$ inches long, and $\frac{7}{8}$ths of an inch high. Judging from their size, I suspected for some time that the young could move in and out of this sack like young opossums, but on carefully examining the position of the young in the pouches, and also the contracted condition of the sphincter at the external orifice of the sexual organs, I remained satisfied that this could not be the case, and that the young Mr Jackson found so lively after putting them in a bucket of salt water, had then for the first time come into free contact with the element in which they were soon to live; but, at the same time, it can hardly be doubted that the water penetrates into the marsupial sack, since these young have fully developed gills. The size of the young compared with that of the mother is very remarkable, being full one-third its length in the one, and nearly so in the other species. Indeed these young Embiotocæ, not yet hatched, are three or four times larger than the young of a Pomotis (of the same size) a full year old. In this respect these fishes differ from all the other viviparous species known to us. There is another feature about them of considerable interest, that while the two adult differ markedly in coloration, the young have the same dress, light yellowish olive with deeper and brighter transverse bands, something like the young trouts and salmons in their Parr dress. The traversely banded species may therefore be considered as inferior to the other, since it preserves through life the system of coloration of the embryo.

It will be a matter of deep interest to trace the early stages of growth of these fishes, to examine the structure of the ovary and the eggs before fecundation takes place, etc., etc. The state of preservation of the specimens in my hands, precluded every such investigation.

Though I know thus far only one single genus of this type, I do not think it right to combine the generic characters with those of the family, as is generally done in such cases, as I would also object to the practice of omitting any specific characteristics where only one species is known of a genus. This shows an entire misapprehension of the relative value and subordination of the characters of animals. I would therefore characterize as follows the genus

EMBIOTOCA, AGASS.

Body much compressed and elevated. Head small, with scales only on the cheeks and opercular pieces. Teeth in both jaws, short, conical, arranged in one row, and slightly recurved. The pharyngeal teeth much shorter and blunter than those of the jaws, and arranged like pavement. Dorsal fin with nine or more spinous rays. The first three rays of the anal fin, spinous, and much shorter than the following articulated rays, which are always finer and more numerous than the corresponding rays of the dorsal fin. The lateral line is continuous to the base of the caudal fin. Whether the peculiar mode of reproduction is a family or a generic character, remains to be ascertained by further investigations. It is however probable that with some slight modifications it will be found the same in all the members of the family.

* Some differences between the two species observed, might render it doubtful whether they ought to be considered as belonging to as many distinct genera or not. But we know that in genera differing greatly from others, the range of the specific differences is also wider than in genera with many species; so until I am taught differently by new discoveries, I would refer them both to one and the same genus. Such doubts could scarcely be entertained respecting families with many genera, where a standard to estimate genuine generic differences is easily obtained.

1. EMBIOTOCA JACKSONI, AGASS.

The body is quite high, of an oval form, greatly compressed and similarly arched above and below. The superior arch extends to the posterior base of the dorsal fin, whence it continues in a horizontal line to the base of the tail. The ventral arch of the body is similar to that of the dorsal outline. The profile from the dorsal fin to the end of the snout, is rather precipitate and regularly arched, except obliquely above and in front of the eyes, where it is slightly concave. The greatest height of the body, including the dorsal fin, is equal so the distance from the end of the snout to the extremity of the pectoral. The head is of moderate size, its length, measuring to the posterior angle of the opercle, being about one-fourth that of the entire fish. The mouth is quite small, the hinder extremities of the intermaxillaries and maxillaries extending not further back than the line of the anterior border of the orbit. But a small portion of the superior maxillary is exposed at the angle of the mouth. The anterior edge of that part of the snout into which the intermaxillaries fit, is on a horizontal line drawn immediately below the orbits. The upper jaw is slightly more prominent than the lower, the teeth of the latter fitting *within* those of the former. In the upper jaw there are fourteen or fifteen teeth; in the lower there are two or three less. They are all slightly swollen near the top, and are not pointed, but rather bluntly edged. They do not extend to the angles of the mouth, but leave a space without teeth on each jaw. The teeth of the upper jaw are but little larger than those of the lower. The teeth of the pharyngeals are much shorter than those of the jaws, and form two quite moveable plates above, and a triangular one below. There are not more than thirty teeth on each of the superior plates, and mostly truncated at the top. The four or five teeth which form the inner row of each plate, are more prominent than the others, and somewhat pointed. The teeth of the inferior pharyngeal plate are similar to those of the upper, but the teeth of its posterior range are the most prominent and pointed. The lips are rather fleshy, and entirely conceal the teeth. Beneath the lower lip there is an elongated pit on each side, extending towards the corners of the mouth; it is covered by a thin border of the lip. The distance from the end of the snout to the anterior border of the orbit is greater than the diameter of the latter by one-third. The inferior margin of the orbit is on the middle longitudinal line of the body; and its posterior body is half way between the end of the snout, and the posterior angle of the opercle. The opercular pieces are large. On the preopercle are four concentric rows of scales; the two inner and anterior are the longer; there are thirteen large scales in the row nearest the eye, and the number is less and less in the others. Still within the row nearest the eye, there is a space without scales, and marked by pores radiating from the edge of the orbit. The posterior and inferior border of the preopercle, outside of the ridge of the latter, is thin, membranous, and without scales, but marked with numerous pores or tubes similar to those around the orbits, and radiating from within outwards.

The opercle, subopercle and interopercle are covered with scales, which decrease in size from the former to the latter. There is a narrow membranous border to the opercle, extending from its posterior angle to the height of the termination of the lateral line. The notch between the subopercle and the interopercle is on a vertical line with the edge of the posterior border of the preopercle. There is a small patch of scales, nine or ten in number, immediately above the superior attachment of the preopercle. The dorsal fin extends over about three-fifths of the superior curve of the body; its posterior portion is one-third higher, as well as longer, than its anterior. The spinous portion has nine or ten rays, the length of the first of which is equal to one third that of the last. At the point of each spine, the fin appears to extend backwards in a loose filament. There are 19½ articulated rays in the dorsal fin: the superior outline of this part is nearly similar to that of the back, although the rays of its first half are the longest, and nearly equal in length. The furrow on each side extends as far forwards as the base of the first articulated ray, where there are rows of scales forming the sheath; but the rows are reduced to one towards the posterior attachment of the fin.

The pectoral fins are of rather large size, and are placed below the middle line of the body, as well as below the posterior angle of the opercle. They extend about as near to the anal fin, as do the ventrals. The second ray of the pectoral is but slightly arched towards its extremity. There are twenty-one rays in each pectoral. The base of the ventrals is just in advance of the middle of this second ray of the pectoral. The spinous ray of the ventrals is three-fifths the length of the following articulated ray. There is a long plate of scales between the ventrals. The anal fin is broad and composed principally of fine slender rays. The last and longest of its spinous rays, equals in length one-fourth that of the following articulated ray, which latter is equal to the corresponding ray of the dorsal fin. The last ray of the anal fin is placed nearer the caudal fin than that of the dorsal. The fin itself at the base of the tail. The caudal fin is deeply forked; it contains fourteen rays, omitting its outer and short rays. There are eight rows of scales between the lateral line and the spinous portion of the dorsal fin, and eighteen rows below the lateral line in the same region. Sixty scales in the lateral line. Colour uniformly dark olive brown, along the back, fading slightly upon the sides; dorsal black, mottled with white; caudal blackish, lighter upon the base; and deep black, with a light longitudinal band; pectorals white; ventrals black with light base.

From the above description, it must be obvious that this is the species first observed by Mr. A. C. Jackson, to whom I have inscribed it, or at least a species very closely allied to it. There is only one fact about it which surprises me, that while he observed mature young in it on the 7th of June, Mr. T. G. Cary should have found it still with young as late as the beginning of August. Again Mr. Jackson saw nineteen young in it, whilst in the specimens forwarded by Mr. Cary, I found only eight or nine young, which were transversely banded like Emb. Caryi. May there be two species so closely allied as to be easily mistaken? I must add, that Mr. Jackson does not mention the mottled appearance of the dorsal, nor the light band upon the anal of his fish; which renders the supposition more probable that there are several and not only two species of this remarkable genus, about San Francisco. I would, however, not forego the opportunity of connecting the name of Mr. Jackson with his interesting discovery, and have therefore called *Emb. Jacksoni*, that one of the species sent me by Mr. Cary, which agrees most closely with his description, leaving it for the future to decide whether this species is truly the one he first saw, a circumstance which is quite immaterial, since we already know two species of this extraordinary type.

2. EMBIOTOCA CARYI, AGASS.

The body is much more elongated than in Embiotoca Jacksoni yet equally compressed. Its height, including that of the dorsal fin, is less than the distance from the end of the snout to the extremity of the pectoral; and less than one-half the length of the fish. The profile is much less steep, and the snout quite as prominent, hence the head is longer than high. The posterior border of the orbit is nearer the angle of the opercle than the end of the snout. The upper and lower curves of the body are equal, and approach more nearly towards the tail, making this latter narrower than in the first species. The scales of the back do not descend upon the head lower than one-half the distance from the first spine of the dorsal to the end of the snout. The forehead is slightly concave as in Emb. Jacksoni. The posterior end of the internmaxillary does not extend as far back as the anterior border of the orbit. The nature of the lips, and extent of the upper maxillary is much as in the other species, but the anterior edge of the socket of the intermaxillaries is *above* the line of the lower border of the orbit. A vertical line through the orbit shows the height of the head in this region to be one-third less than in E. Jacksoni. The opening of the mouth is directed more obliquely upwards. The teeth are more slender, but have otherwise the same form. In the upper jaw there are twelve, in the lower eight teeth. The nasal openings are of tolerable size; one before the other, and in advance of the eye, but slightly below the line of its superior border. The vertical diameter of the orbit is less than its longitudinal; and its posterior border is nearer the angle of the opercle than the snout. The preopercle in this species is less rectangular than in the former. The inferior rounded angle of its *ridge* is in *advance* of the posterior margin of the orbit. The scales of the preopercle are also much smaller and less conspicuous. Tubes radiate from the border of the orbit and from the ridge of the preopercle, as in Emb. Jacksoni. The posterior membranous border of the opercle is narrower: the notch between the subopercle and interopercle is on the vertical line of the posterior border of the preopercle. There is a patch of scales above the superior attachment of the preopercle. The dorsal fin differs very little in form from that of the former, but extends somewhat farther forwards, its first spine being immediately over the posterior angle of the opercle. The distance from this spine to the end of the snout equals the distance from the same back to the ninth articulated ray. The posterior rays of the articulated portion are shorter than in the first species, but they are more numerous by three rays. The pectoral has twenty-one rays; it is perhaps longer than in the other. The ventrals differ little. The anal fin however, differs greatly: it is very small and contracted, and is placed far behind the ventrals. The scales at its base form a waved outline much more marked than in E. Jacksoni. The spinous rays are very short, the last being less than one-half the length of the following articulated ray, the base of which latter is directly under that of the fifteenth corresponding ray of the dorsal fin. Its posterior base and termination are as in the first species. The caudal fin however, is more slender, and more deeply notched. The scales of the body are by no means so large. The lateral line, follows the outline of the back, as in E. Jacksoni; there are seventy-five scales in it.

Color light olive, darker along the back; light brown longitudinal bands extend between the rows of scales, and darker transverse bands reach from the back to the sides of the body, not extending below the lateral line in the anterior part of the trunk, but more marked, and reaching nearly to the anal fin upon the tail. Head mottled black and white. Dorsal and caudal dotted with black and white. Anal with a large diffuse black mark upon lighter ground. Pectorals white. Ventrals white at the base, terminated with black.

Only one female has been observed, containing eight young. This species was discovered by T. G. Cary, Esq., in the Bay of San Francisco, in the beginning of August, 1853.

Directions for Collecting Fishes.—By Louis Agassiz.

The present condition of our science requires collections made in a very different spirit from those gathered in former years. The naturalist must not only know all the different kinds of animals; he must also become acquainted with the changes they undergo while growing, and with their geographical range. To arrive at this knowledge, it is necessary to obtain, separately, complete collections from every district upon the mainland, from every inlet along the sea-shores, and from every distinct fresh water basin, and to select a number of specimens of every kind, if possible so as to include the young as well as the adults, males and females.* The number and diversity of species found in our fresh waters especially, is much greater than is usually supposed by accidental observers. A variety of little fishes, sometimes belonging even to different families, are almost everywhere used for bait by fishermen, and frequently mistaken under one common name, minnows, are supposed to be simply the young of larger kinds. Among these, most valuable discoveries may be made. There are still districts in our country where a naturalist may fish half a dozen new species and more of these small nondescripts, in a single creek, within a few hours.† A small hand-net is very useful to collect these smallest kinds of fishes, and I have generally found that I could more easily obtain this small fry from boys, than from either fishermen or anglers. Again, scores of fishes are indiscriminately called bass, perch, sunfish, suckers, &c., in different parts of the country, which, when compared side by side, prove as different from one another as a robin and a crow. It is, therefore, a matter of great importance for the naturalist to net every species of fish from every water basin, that he may have an opportunity of ascertaining for himself how far they agree, and how far they differ, in different watercourses. Anglers and professional fishermen generally know the fishes of their own fishing grounds much better than naturalists, and from them most valuable information may be obtained respecting the species inhabiting their neighbourhood. There is, on that account, no difficulty in ascertaining from them whether a complete collection of all the fishes of any given locality has been obtained. But the difficulty begins when it is attempted to identify the fishes of different places, relying upon their names for comparison. Such is the confusion of these names in different sections of the country arising from the use of the same names for different objects, and of different names for the same objects, that nothing short of complete collections obtained *separately* from every important locality will prevent the naturalist from making gross mistakes in his identification of species from remote localities. Few men not trained in the study of natural history are prepared to believe that even the fishes living in the head waters of a river may differ entirely from those living in its middle and lower course, and that it may therefore be necessary to make separate collections in different parts of one and the same water-basin. This is still more important respecting distinct water-systems, But a complete survey ought to cover the whole ground as soon as possible. It would not be too much to have one collection for every hundred miles upon our large streams, and one for every fifty and even for every twenty miles upon smaller rivers.

The preservation of fishes requires but little care and attention. Any vessel, jar, can, keg, or barrel fit to hold alcohol, is also fit for collecting fishes, which may be heaped upon it like herrings in salt. The alcohol used must be of about the strength of that that of .88 specific gravity‡ for most fishes; for suckers and brook-trouts, however, it ought to be stronger, about .80, their flesh being either soft or fat, and more readily decomposed. In *summer or in warm climates* it is advisable to use always strong alcohol to obviate the effects of evaporation. Suppose it is intended to make a complete collection from one of the larger tributaries of some of our great rivers. All that is wanted will be a

* There are many species of our fishes in which the sexes differ as much as among our fowls.

† It actually happened to me last winter, at Mobile, Ala., and at St. Louis, Mo., to discover six and even eight new species of fishes in a single day.

‡ Common whiskey of .90 to .92 specific gravity may be used by adding strong alcohol, in the proportion of one gallon of alcohol to one gallon of whisky. Highly rectified whisky as it is prepared in some parts of the country, may occasionally do by itself, especially if it has nearly the specific gravity of .88. It is, however, always safer to err by using too strong than too weak spirits. Specimens may be contracted by too strong alcohol, and lose to some extent their form; they will certainly spoil entirely in too weak a mixture.

few jars, such as are used to keep preserves, a barrel of about fifteen or twenty gallons, and a supply of whisky and alcohol. These may be kept in a cool place, a cellar, or a sheltered recess, ready to receive the fishes. The smallest fishes are best kept by themselves in jars, and the larger ones in a barrel. The barrel ought to be put upon one head, the other removed and used as a cover. It will be well to see that the fishes are placed in it in as natural a position as possible, that is to say, stretched out with the fins closed against the body, or at least not unnaturally bent. It is equally desirable to exclude specimens the fins of which are bruised, and the scales rubbed off, unless they be rare species. When the fishes are too big to be stretched across the barrel, they may be gently bent upon the flatter side, and if too stiff to allow this, put in, head foremost, in an upright or slanting position, and then slightly bent against the sides of the barrel. It is useless at first to pour more alcohol over the fishes than is necessary to cover them. While cruizing at sea, it will be well to throw some rags over the specimens to prevent their jarring, until the vessel in which they are contained is quite full and headed up. Of the smaller kinds of fishes, at least a dozen of each would be required for a full and satisfactory examination. Where they may easily be caught, more would be very acceptable. Of those of medium size, about half that number; and of the larger ones, as may be most convenient, one, two, or three. It will secure a better state of preservation, and afford fuller means of study if a cut is made into the belly of the larger fishes, to allow the alcohol to penetrate into the intestines. At all events, these ought never to be removed. The knowledge of the local names is very desirable. To rectify the errors of nomenclature now spread over the whole country, the simplest way of recording the name of a fish is to write it with a black, hard pencil upon a piece of stiff paper, or with indelible ink upon cloth, and to place such paper under the gill-cover of the specimen to which it belongs. Specimens too small to be labelled in that way may be rolled up in a piece of cotton cloth upon which the name is written. Delicate fishes, with very deciduous scales, would keep better if they were wrapped up singly in this way in cloth. Any other notices respecting the habits, uses, &c., of such specimens may be preserved in the same manner, or referred to a No. inscribed upon the label of the fish. It would be very important to record as far as possible the date at which the specimens preserved were caught. This may often enable the anatomist to determine the spawning season of the species. Also, the depth at which they are known to live. Should any collector be sufficiently familiar with painting to draw coloured figures of any of these fishes, or so situated as to have some of them drawn by an artist, it would be an invaluable contribution to Natural History.

When collections have to travel over great distances, or to be for many months on a journey, it is desirable that every specimen should be wrapped up singly in a piece of cloth; but this is not necessary, generally speaking, for collections which are likely to be taken care of after a short journey.

Those unaccustomed to making collections may occasionally suppose from their smell that they are spoiling, the mixture of alcohol with dead animal matter being rather disagreeable; but unles there is actual putrefaction, no apprehension need be had respecting the safety of a collection, and the removal of decayed specimens is all that is required for the preservation of the remainder, provided the alcohol has the necessary strength of at least twenty-eight degrees of Beaumé, or .88 specific gravity. To avoid losses, it is prudent never to use kegs of more than twenty to twenty-five gallons, save in exceptional cases, where very large and highly valuable specimens are to be preserved. As a general rule a twenty-five gallon keg will contain any desirable specimen collected even in our largest rivers, there being always an opportunity now and then to obtain a moderately large specimen of our largest fishes, which when full grown are at any rate too bulky to be preserved in alcohol. Upon small watercourses, or small ponds, an ordinary jar may be sufficient to contain complete separate collections of their natural productions. Of very large fishes, especially of sharks and skates, the skin may be preserved, leaving the whole head attached to it, and rolled up, preserved like other specimens in alcohol. A longitudinal cut upon one side, in preference the right side, will afford sufficient facility for removing the intestines and all the flesh and bones of the body. Skeletons would be also very desirable. To obtain them it is simply necessary to boil the animal, either whole or in part, and to gather and clean all the bones, and preserve them together in a sack. A naturalist will readily put up the loose parts in their natural connexion.

Extracts from the First Report of the Secretary of the Board of Registration and Statistics on the Census of the Canadas for 1851—52.

The returns of a population Census acquire their chief utility from being contrasted with those of former periods, as from this comparison we learn the increase or decrease of the population, the annual rate of such variations and the proportionate relation of the two sexes. From these results as it has been said, "we approximate to something like a Law of Population, or to certain natural rules, the infraction of which must be due to particular and perhaps removable disturbing causes." It has been found that although the population of Great Britain has increased upwards of ten millions during the last half century, yet throughout this period, the sexes have presented their relative proportion, viz.: 30 males to 31 females.

Until the Abstracts of the personal census are completed, it will be impossible to do justice to this most interesting feature of the census. A few general remarks must at the present time suffice, and our chief attention be directed to the agricultural produce and prospects of the country.

It is believed that a very general feeling prevails, not only in the Mother Country but even in Canada, that her growth and prosperity are not commensurate with that of the United States, and without any inclination to deny or conceal the rapid progress of our neighbours, it may be well by a few facts, compiled from statistical returns, to prove how erroneous such an impression is—the growth of Upper Canada, taking it from the year 1800, having been nearly *thrice* that of the United States.

According to the "World's Progress," a work published by Putnam, of New York, in 1851, page 481—the free population of the United States was in 1800, 5,305,925; in 1850, it was 20,250,090, (in 1810 it was 7,239,814,) thus in 50 years its increase was not quite 400 per cent., whilst that of Upper Canada was upwards of 1100 per cent, for the 40 years from 1811 to 1851.

Comparing the last decade of Upper Canada with that of other countries, exclusive of Australia and California, we arrive at the following result:

The total number of inhabitants in the United States, on the 1st June, 1850, according to the census report, was 23,263,488, but it has been shown that the probable amount of population acquired by territorial additions should be deducted in making a comparison between the last and former census. These diminish the total population of the country as a basis of comparison to 23,091,488.

United States—Census of	1850..	23,091,488
"	1840..	17,067,453
Increase in 10 years..		6,022,035 or 35,27 per cent.

Great Britain—Census of 1851..	21,121,967	
" 1841..	18,658,372	
Increase in 10 years..	2,463,595	or 13,20 per cent.
Ireland—Census of 1841..	8,175,124	
" 1852..	6,515,794	
Decrease in 10 years..	1,659,330	or 20 per cent.
Upper Canada—Census of 1851..	952,004	
" 1841..	465,357	
Increase in 10 years..	486,647	or 104,58 per cent.

The first census of Great Britain was taken in 1801, at which date the population amounted to 10,567,893, and thus it has doubled itself in half a century, an increase nearly equalling that in all preceding ages. It is supposed that in the eleven centuries which elapsed between the landing of Julius Cæsar and William the Conqueror, the population hardly doubled itself; thus, that which in former times it required eleven centuries to accomplish in England, has been done in Upper Canada in 10 years. The census returns of all countries prove how much faster population increases in modern than in ancient times. In the last 10 years 5,308,181 have been added to the population of Great Britain, which exceeds the known increase of the last 50 years of the last century.

Whilst the population of almost all other countries is increasing that of Ireland is, from various causes, 286,033 less than it was in 1851; the greatest decrease has been in the county of Cork, where, in 10 years, the population has been reduced from 773,398 to 551,152.

It may be argued that it is not fair to take the whole of the United States for a comparison with Upper Canada, much of that country being comparatively old and long-settled. It will be seen from the United States census, that the three States of Ohio Michigan and Illinois contained in 1830, 1,126,851. In 1850 they contained 3,505,000, a little over 320 per cent. in 20 years.

Canada West contained in 1830, 210,437; in 1849, it contained 791,000, which is over 375 per cent. for the same period of 20 years—so that the increase in these three choice States was 55 per cent. less than that of Canada West during the same time. The Western States attract an enormous population and at this time settlers are crowding into Iowa, and peopling the banks of the Missouri.

The statistics of Canada prove the same feeling to exist here as in the United States. The Gore and Wellington Districts have increased 1900 per cent. in 33 years up to 1850. The Western District has increased over 700 per cent.; the London District, 550 per cent.; the County of Norfolk, 550 per cent.; the County of Niagara about 380 per cent.; while in eight years the County of Oxford has doubled its population.

And in the far West of Canada the Counties of Huron, Perth and Bruce, have increased from 5,600 in 1841, to 37,580 in 1851, being upwards of 571 per cent. in 10 years, an increase almost beyond comprehension. It appears from Smith's work on Canada, that the Huron District has made more rapid progress since its first settlement in 1827, than the States of Ohio, Michigan and Illinois did in double that time, or than Lower Canada did in 104 years; the latter is doubtless owing to the almost entire absorption by Western Canada of the vast immigration from Europe.

This immense increase is not however confined to the rural districts, for the cities and towns will equally vie with those of the United States, and a few extracts from the Rev. Mr. Lillie's excellent lectures on the growth and prospects of Canada, afford an interesting proof of this fact.

The population of Boston was,

In 1790	18,038
1810	33,250
1820	43,299
1830	61,391
1840	93,000
1840	135,000

"Dividing the above into two periods of 30 years each. Boston contained at the close of the first about 2½ times its number of inhabitants at the commencement, while the close of the second shows 3 1/15 times the number of the beginning, the population of 1850 is eight times (or nearly) that of 1790. Toronto being in the former of these years over six times what it was 18 years before (in 1832,) and more than 75 times what it was 49 years before (in 1801.) Between 1840 and 1850, the increase was on Boston 45 per cent.; on Toronto 95 per cent."

"New York, the emporium of the New World and a city which for its age may vie with any in the world, numbered—

In 1790	33,131
1810	96,373
1830	202,548
1840	312,710
1850	517,000

Its increase thus stands as compared with Toronto—2½ times in the 20 years from 1830 to 1850, against 6 times in the 18 years between 1832 and 1850,—16 times in 60 years against 75 times in 49 years—66 per cent. between 1840 and 1850, against 95 per cent.

"St. Louis, which had in 1850, 70,000 inhabitants had increased it 15 times that in 1820. Toronto had in 1850 increased hers 18 times that in 1817."

"The population in Cincinnati was in 1850, 115,590, or 12 times its amount in 1820. 30 years before; and Toronto had in 1850, 18 times its population in 1817, or 33 years before."

Hamilton had in 1836 a population of 2,846 and now by the last census 14,112.

Dundas has in 6 years increased from 1,700 to 3,517.

The increase in Brantford during the last 10 years has been nearly 300 per cent. and during the year 1850–51, rose from 3,200 to 4,000, or 25 per cent. Belleville, in the same period has increased from 3,500 to 4,569. London, from 5,124 to 7,035.

Galt has increased in five years from 1,000 to 2,248, and Guelph in 7 years from 700 to 1,8[illegible].

Woodstock has increased in 1850–51, from 1,200 to 2,112, and Ingersoll has increased in 4 years from 500 to 1,190.

Kingston, in 10 years, from	6,292	to	11,585
Toronto, " "	14,249	to	30,775

Lower Canada, though not advancing in the same ratio, presents some few instances of an enormous increase in her population. Among these we may instance—

The County of Megantic, which in 7 years, from 1844 to 1851 increased from 6,449 to 13,835, or at the rate of 115,40 per cent.

The County of Ottawa, which in the same time has increased from 12,434 to 22,903, or 84.42 per cent.

The County of Drummond, from 9,354 to 16,562, or 77.28 per cent., and

The County of Sherbrooke, from 13,485 to 20,014, or 49.47 per cent.

The following table, which may be interesting for the purpose of reference, is compiled from Weber's Almanac for 1853, published at Leipsic, and gives the population of the largest cities of Europe and North America. As the Germans are proverbially accurate in their statistical statements, it is believed that it may be relied upon as correct.

1.	London	2,363,141	34.	Pesth	125,000
2.	Paris	1,053,262	35.	Prague	124,181
3.	Constantinople	786,990	36.	Barcelona	120,000
4.	New York	522,766	37.	Genoa	120,000
5.	St. Petersburg	478,437	38.	Cincinnati	116,710
6.	Vienna	477,846	39.	New Orleans	116,348
7.	Berlin	441,931	40.	Bristol	115,000
8.	Naples	416,476	41.	Ghent	112,410
9.	Philadelphia	409,354	42.	Munich	106,770
10.	Liverpool	384,263	43.	Breslau	104,000
11.	Glasgow	367,800	44.	Florence	102,154
12.	Moscow	350,000	45.	Rouen	100,265
13.	Manchester	296,000	46.	Belfast	98,660
14.	Madrid	260,000	47.	Cologne	92,244
15.	Dublin	254,000	48.	Dresden	91,277
16.	Lyons	249,325	49.	Stockholm	90,823
17.	Lisbon	241,500	50.	Rotterdam	90,000
18.	Amsterdam	222,800	51.	Antwerp	88,800
19.	Havana	200,000	52.	Cork	86,485
20.	Marseilles	195,257	54.	Liège	77,587
21.	Baltimore	189,054	54.	Bologna	75,100
22.	Palermo	180,000	55.	Leghorn	74,530
23.	Rome	172,382	56.	Trieste	70,846
24.	Warsaw	162,597	57.	Konigsberg	70,198
25.	Leeds	152,000	58.	Sheffield	68,260
26.	Milan	151,438	59.	The Hague	66,000
27.	Hamburg	148,754	60.	Leipsic	65,370
28.	Boston	136,788	61.	Oporto	62,000
29.	Brussels	136,208	62.	Malaga	60,000
30.	Turin	135,000	63.	Dantzic	58,012
31.	Copenhagen	133,000	64.	Francfort	57,550
32.	Bordeaux	130,927	65.	Magdeburg	56,629
33.	Venice	126,768	66.	Bremen	53,166

The following is the rate of increase in the Population of Upper Canada from the year 1811.

In 1811	the population was	77,000	according to Bouchette.			
1824	ditto	151,097	rate of inc.	7.40	p. ct. p. an.
1825	ditto	158,027	ditto	4.59	ditto
1826	ditto	163,703	ditto	3.60	ditto
1827	ditto	176,059	ditto	7.54	ditto
1828	ditto	185,526	ditto	5.37	ditto
1832	ditto	261,060	ditto	10.18	ditto
1834	ditto	320,697	ditto	11.42	ditto
1835	ditto	336,469	ditto	4.91	ditto
1838	ditto	385,824	ditto	4.88	ditto
1839	ditto	407,515	ditto	5.62	ditto

In 1840	the population was	427,441	rate of inc.	4.88	p. ct. p. an.
1841	ditto	465,357	ditto	8.77	ditto
1842	ditto	486,055	ditto	4.45	ditto
1848	ditto	723,332	ditto	7.7	ditto
1851	ditto	952,004	ditto	10.54	ditto

AGRICULTURAL PRODUCTIONS:

	Brls.	Bush.
Total Export of Wheat in 1851,		933,756
Total Export of Flour in 1851,	668,623	
	or	3,343,115
Total Home consumption, allowing 5 bushels for each inhabitant, in a population of 1,842,265,		9,211,324
Total Seed at 1½ Bushels per acre:		
Upper Canada,	780,385	
Lower Canada,	335,926	
	1,116,311	
At 1½ Bushels per acre		1,674,466
Total number of Bushels of Wheat on these calculations,		15,162,662
Total returned by Census:	Bush.	
Upper Province,	12,802,272	
Lower Province, about	3,400,000	
		16,202,272
Total growth of Wheat in all Canada, calculating the Flour at 5 Bushels per Barrel—the consumption at 5 Bushels per head—and the Seed at 1½ Bushels per acre,		15,162,662
		1,039,610

Leaving 1,039,610 Bushels to be accounted for in some other way.

The Home consumption is probably very nearly five and a-half Bushels for each individual; the seed required in 1853 would be for the increased number of acres under Wheat in 1854.

In the United States the Home consumption is calculated at six bushels per head,—but there appears to be no ground for such a calculation, especially as so much Indian Corn is used for food—and in fact the whole growth of Wheat in 1850, as given on page fifty-seven of the Abstract of the last Census of the United States, divided into the population of the same year, gives only $4\frac{16}{100}$ bushels for each inhabitant, whilst the Returns of the Canada Census give more than double that amount, viz: $8\frac{46}{100}$ bushels.

It is true that the quantity of Indian Corn per individual is much larger in the United States than in Canada, but it is well worth observing, that, deducting the Exports of that year, amounting to about 12½ millions of bushels, (allowing five bushels to the barrel of Flour,) as appears in page fifty-seven of the Abstract of their last Census,—and allowing 12½ millions for seed at 1½ bushels per acre, their individual consumption of Wheat is little more than three bushels per head—whilst that of Canada is 5½—this may be accounted for by the increased consumption of Rice as well as Indian Corn.

In the United States the growth of Wheat has increased about forty-eight per cent. during the last ten years, whilst in Canada, during the same period, it has increased upwards of 400 per cent!! And taking the article of Indian Corn, which is the production that compares most favorably for the United States, the increase on it for the ten years between 1840 and 1850, has been equal to 56 per cent. viz: from 377½ millions of bushels to 592⅓ millions,—(see page 60 of Mr. Kennedy's Report,)—whilst the increase in Canada for the last nine years has been 163 per cent., the Census having been taken in 1842 and not in 1841. During the same period also, the increase in the growth of Oats in the United States has been 17 per cent., whilst in Upper Canada it has been 133 per cent.,—in Lower Canada, 41 per cent., —and in both united 70 per cent.

In Peas we find the increase in Upper Canada has been 140 per cent., in nine years—that of the United States, or any of them, is not given in the Abstract of the Census; but, with them, it appears to be an article of little importance, the whole crop of all the States and Territories, being only a few bushels over the produce of Canada.

In comparing the different columns of the foregoing tables, some not uninteresting inferences and deductions may be drawn.

It will be perceived that though the number of cultivated acres in Ohio is one-fourth greater than those of Canada, being 9,800,000 to 7,300,000, or rather more than ten to seven, yet the bushels of Wheat are one-twelfth less, being in Ohio 14,487,000 to 16,202,272.

Ohio, in cultivated acres, possesses $\frac{1}{12}$ of all the United States In uncultivated acres, possesses $\frac{1}{23}$ of the same.

She possesses one-fourth more cultivated land per inhabitant than Canada, having five acres to four.

All Canada produces one-seventh more bushels of Wheat than Ohio, and $1\frac{1}{2}$ bushels more per individual. Upper Canada, however, produces six bushels more Wheat per individual than Ohio—the latter producing in her staple Indian Corn twenty-nine times more than Canada, which produces 77 times more Peas, and 54 per cent. more Oats than Ohio. The land of Ohio is valued at nearly double that of the average of the Union,—(see the Report of Mr. Kennedy, page 46,)—and has more than three times as many inhabitants to the square mile as the Average of the Union—she having $49\frac{55}{100}$ and the average of the States being $15\frac{75}{100}$.

The produce of Wheat per acre in Upper Canada is $16\frac{14}{80}$ and Lower Canada $7\frac{2}{80}$ bushels per acre. The Census Superintendent in the States has followed in the foot-steps of the English Superintendent in not giving an account of the number of acres under any particular description of crop, and thus we can form no just opinion of acreable produce. This is much to be regretted as the more we particularize comparisons, not only of County with County, or State with State, but Townships with Townships, Fields with Fields, and Acres, with Acres, the more easy shall we find it to draw useful deductions to account for success here, or failure there, and to ascertain whether it be climate, or soil, or management, or skill, or the absence of them, or defect in them, that gives one locality an advantage over another.

To give an example of this, it is only necessary to see the vast difference which exists in the amount and value of different productions in different parts of the same country.

In the article of Wheat, we find that the whole United States produced in 1850, only 100,479,000 bushels, whilst the one State of Ohio,—one out of 32 and 4 large territories—produced more than one-seventh of the whole Union.

Again, Ohio produced $7\frac{1}{2}$ bushels for each inhabitant, whilst the whole of the United States produced only $4\frac{1}{3}$—the former having one-eighth of her cultivated land under wheat, whilst the whole Union has not one-twentieth of the cultivated land under that crop.

With perhaps equal advantages, we find an enormous discrepancy in some of our own wheat-growing districts. In the year 1850, the Township of Esquesing in the County of Halton, produced 26 bushels of wheat to the acre, and that of Adolphustown, in the County of Lenox, only 6 bushels to the acre, and this with soil and climate perhaps equally good. This is at once accounted for by the ravages of that fearful plague to the farmer the weevil. The worst wheat crops in Canada West, in the year 1851, were in those counties where the weevil was prevalent. It committed the most serious depredations, in very many cases rendering whole fields of most promising wheat not worth the threshing. This fly, which deposits its larvæ in the blossom of the wheat, in order to feed upon the milk of the grain as it ripens, was unfortunately in that year the most abundant in the Counties of Frontenac, Lenox, Addington, Hastings, and Prince Edward, and is travelling gradually west at the rate of about nine miles every summer, and remains from five to seven years in a locality. The only prevention yet discovered has been to sow early seed on early land, and very early in the autumn, so that the wheat may blossom before the enemy takes wing, the period for which depends much upon the earliness of the season. So destructive was the fly in 1851, that the fine agricultural county of Lennox produced only 6 bushels per acre, Hastings about 10, and Prince Edward, Addington and Frontenac, about 11. It had not in that year reached the County of Northumberland, but was very destructive in that county the following year, 1852.

Canada possessed, in 1851, 46,939 more milch cows than Ohio, and yet Ohio produces $\frac{1}{3}$ more butter, and nearly eight times as much cheese as Canada.

This is a most important feature in the difference between the two countries — amounting annually to the large sum of £276,122 for butter, and £376,703 for cheese, in favour of Ohio, although Canada possesses nearly 47,000 more cows. How to account for so great a difference, the prices being taken at the same rate in both countries, is a very difficult matter. The having a more congenial climate than Canada East, shorter winter, and the supply of green food continuing for a larger period, may account for a great deal, but certainly not for such a serious discrepancy. The natural inference is that the breed of cows in Canada must be very inferior to those of Ohio.

It may, however, fairly be observed that Ohio exceeds the average of the whole United States, in the amount of butter per cow, 27 per cent., and in the amount of cheese, 133 per cent.; Upper Canada exceeds the average of the whole Union by about 9 per cent. in butter, but is very deficient in cheese. The difference in the value of the yield of one cow in Upper Canada and Ohio, calculating the price of butter at $7\frac{1}{2}$d. per lb. and cheese at 5d., in both places, would be 16s. $10\frac{1}{2}$d. in favour of Ohio, and the extra milk and whey would make 20s., supposing the returns to be correct, which there is no good reason for doubting. As a proof, however, if proof were necessary, that the climate of Ohio is much less severe than that of Canada, it may be stated that although she has one-third more horses, viz: 78,020—about 63,000 more young cattle, and $2\frac{1}{2}$ millions more sheep, she produces less hay by 204,203 tons, and very much less straw and other fodder, even allowing that she has 29 times more corn stalks.

The increase in the production of the articles of butter and cheese in Canada, has notwithstanding been enormous, and we find that within the three years, 1849, 1850, and 1851, the amount of butter produced has, in the Upper Province, increased 372 per cent., and that of cheese during the same period, 233 per cent., which leads to the inference, that our milch cows are rapidly improving in quality. The census returns of the Lower Province, previous to the year 1851, are very deficient as to the amount of these articles.

The next most important feature in the difference between Ohio and Canada is in the number of their sheep, and the consequent value of their wool. Here, too, the difference is difficult to be accounted for, but the fact should open the eyes of the Canadian farmers to their interest.

The number of sheep in Canada, in round numbers, is 1,600,000, in Ohio, 4,000,000, although the number of acres *occupied* is very nearly the same, and the number of acres *cultivated* only about one-third greater than in our Provinces.

In the value of wool alone the annual difference in favour of the former is	£606,564
And in sheep at 7s. 6d. each, it is	879,405
	£1,485,969

the latter item being capital, which, deducting the expense of keep, &c., pays at least 33 per cent. per annum, net profit, and allowing for increase in numbers every year, might fairly be calculated at fifty per cent.

It must, however, be observed, that notwithstanding the striking superiority of Ohio in this particular, the rate of increase in the number of sheep, as compared with that of the United States would appear, from page 67 of Mr. Kennedy's report, to be greatly in favour of Canada, for in ten years, the increase in the States has been only *ten per cent.*, and in the weight of the fleece only 32 per cent., whereas in Canada the increase in wool has, in nine years, been 64 per cent., and that of sheep 35 per cent., showing an improvement in the weight of the fleece of not far off 30 per cent.

The average weight in Canada is found to be:

In Upper Canada	$2\frac{14}{16}$ lbs.
In Lower Canada	$2\frac{1}{16}$ lbs.
In all Canada	$2\frac{12}{16}$ lbs.

Whilst in the United States it is, as per page 67 of the Abstract, $2\frac{7}{16}$ or $2\frac{43}{100}$ lbs., showing on excess in favour of Canada in the average of nearly 3 oz. per fleece. The proportion too in both countries i. e., the whole United States and Canada, is about the same, being about 9 sheep to every 10 inhabitants. Upper Canada has about 10 sheep to every 100 acres occupied; Lower Canada has 8, and the *United States* has $7\frac{15}{100}$.

With regard to horses, there are in both Canadas, according to the Census Returns 385,377, or very nearly one to every five inhabitants, and they have increased during the last nine years 48 per cent. In some counties the increase has been very much greater than this, for we find in Oxford an increase of 350 per cent., and in some townships in that county even 400 per cent.; this would induce a belief that there was some great error in the returns of 1842: but there seems to be no good reason why the number of horses should not have kept pace with the population; the wealth of the latter having also during that time so materially increased. If in nine or ten years, the population has increased cent. per cent.; it is almost unaccountable that the number of horses should not have increased in a similar ratio.

It is stated by the Census Superintendent, that in the United States, where Railways have been extensively constructed, the number of horses has very much decreased, and according to the abstract accompanying his last Report, the number in New York had decreased by 26,366; in Pennsylvania by 13,000; in New England by 77,000, or more than 25 per cent., "while in all the States (he remarks) railroad conveyance "has almost superseded the use of horses *for travelling purposes along the main routes*." He adds, "we would more readily attribute the apparent diminution to the omission to enumerate the horses in cities and towns than to any superseding of horse power."

There can be no doubt that this must be the reason for any apparent decrease, for the experience of other countries shows a very different effect, as produced by railway travelling.

In Great Britain, the number of horses employed at the great *railway termini*, and the numerous *intermediate stations*, very far exceeds the number formerly employed in the stage and posting departments. The facilities afforded by railway communication, and the saving of time, combined with so much greater comfort, has led to an enormous increase of travellers, and the tens who formerly travelled between the chief cities and towns of a country, either on business or for pleasure, are now multiplied to hundreds. The main routes may be comparatively deserted, but it is difficult to believe that the construction of railways, which must be fed at every point with their freights, living as well as dead, can have any other effect than an increase in the employment of horses.

The horses and mules of the whole Union, constitute a proportion of 1 to 5 of the inhabitants. New York has only 1 to 7; Pennsylvania 1 to $6\frac{6}{10}$; and Ohio has 1 to $4\frac{3}{10}$. In the new States of the West, the increase in horses has kept pace with that of the population, and so also in Canada West the new townships show a far greater increase than the older ones.

From this kind of comparison it will be seen that there are various branches of agriculture well deserving of the increased attention of the Canadian farmer.

Ohio far exceeds Canada in indian corn, butter and cheese, grass seed, wool, tobacco, and beef and pork.

Canada far exceeds Ohio in wheat, peas, rye, barley, oats, buckwheat, hay, hemp and flax, hops, maple sugar and potatoes; and also, considering that Ohio has one-third more cultivated land, in total value of live stock. This bears a proportion of only $12\frac{3}{4}$ to 11, whilst the cultivated *land* of Ohio to that of Canada is as 10 to $7\frac{1}{2}$.

In all the above enumerated articles, viz.: live stock, grain, other farm produce, articles manufactured from flax, hemp and wool, beef and pork, Ohio exceeds Canada by £8,199,310, being very little over one-third more than the produce of Canada, and if the produce of the Forest be calculated, of which Canada exported in 1851, value for one million and a half of pounds, the relative wealth per acre would be in favour of Canada.

The ratio of increase of population in Ohio for ten years, from 1840 to 1850, is $33\frac{33}{100}$ per cent.—that of Upper Canada in the same period has been $104\frac{53}{100}$ per cent.—that of Lower Canada for seven years, from 1844 to 1851, has been 20 per cent.

When it is considered that there are 31 States, 1 District, and 4 Territories: and that Ohio has 8 per cent. of the whole population of the Union.—$8\frac{3}{4}$ per cent of the grain of the whole Union except rice,—and about $10\frac{1}{2}$ per cent. of all other agricultural produce not manufactured, and seven per cent. of butter, cheese, beef, pork and domestic manufactures of the whole union, and that Canada equals Ohio in acreable produce, is there not good reason for expecting that Canada, with her more extended scope, and her more rapidly increasing population, will, in a very few years, make a much nearer approximation to the population of the whole Union than Ohio does now.

Already the population of Canada is more than $\frac{1}{13}$ of the Union—the area in square miles, exclusive of the Territories is one-sixth, and of course in acres the same—in occupied acres about $\frac{1}{7}$—in growth of wheat very nearly one-sixth of the whole Union—in barley more than one fourth; in oats one-seventh; in buckwheat one-eighth; in all grain, including Indian corn about $\frac{1}{16}$,—exclusive of Indian corn about one-sixth. Of rice, Canada has none, neither has Ohio,—the whole Union produces 215,312,710 lbs., which at three pence per pound would be £2,691,408 in favour of the Union.

Even at present, Canada compares most favourably in proportion to her population with the States, and, when the railroads now in course of formation shall have united the whole British possessions in North America, the increased facilities and aroused and invigorated energies, and improving climate and more rapidly increasing population, and interminable water communication, and extensive fisheries will, in a few years, enable the British North American possessions to make no unfavourable comparison with the Union, flourish as she may.

The whole area of the United States and territories is 3,230,572 square miles which multiplied by 640 gives the number of acres 2,057,566,080, certainly a prodigious territory, but the British possessions in North America far exceed this.

The exact amount according to Allison, is 4,109,630 square geographical miles, and the water in British America is 1,340,000 square miles. The whole terrestial globe embraces about 37,000,000 square miles, so that British America contains nearly a ninth part of the whole terrestrial surface of the globe—the number of acres is 2,630,163,200. Allison remarks that a very large portion is, perhaps, doomed to everlasting sterility, owing to the severity of the climate—such is no doubt the case; but it should be recollected that as the country becomes cleared up, the climate improves, and that there are at present twenty or thirty millions of acres, to the successful cultivation of which the climate presents no insuperable barrier.

Two or three centuries ago the Rhine used to be frozen, and the animals, the natives of the northern regions, were abundant on its banks—how different is the case now? It will be so in British North America, with this difference, that the improving climate will keep pace with the vastly accelerated movements, and more rapidly increasing numbers of the New World settlers.

Standards of Length and Weight.

It will be remembered that the destruction of the Houses of Parliament by fire, in 1834, proved fatal to the standard Yard and Pound. A commission was subsequently appointed to consider the steps to be taken for the restoration of those standards,—the members of which were all Fellows of the Royal Society.

The late Mr. Baily took an active part in the preparation of a standard yard; which, however, though constructed most carefully, deteriorated in such a manner as to be altogether unworthy of confidence. Since Mr. Baily's death, the Rev. Mr. Sheepshanks has been engaged in the very difficult and delicate task of constructing a standard yard,—while Professor Miller, of Cambridge, undertook to make a standard avoirdupois pound. The liberality of Government placed at Mr. Sheepshanks' command apparatus for his purpose far superior to that possessed by his predecessors. His labours were carried on in the lower tiers of cellars in Somerset House,—which are very favourable to the work, on account of their slow-changing temperature.

After an infinite number of experiments and comparisons, two standards have been constructed. The originals have been inclosed in one of the walls of the New Houses of Parliament; and perfectly accurate copies were placed by Mr. Airy in the custody of the Royal Society on Thursday last.

The standard yard measure is defined by the interval between two lines upon a bar of gun metal. The bar is about 38 inches long and 1 inch square; it is supported in a horizontal position upon eight brass rollers, which are carried by levers so arranged that the pressure upon the eight rollers are necessarily equal.

I

The lever frame, with the bar resting upon it, is placed in a box of mahogany wood. The bar is prevented from moving endways by weak brass springs attached inside to the ends of the box, and is prevented from moving upwards by wedges of paper placed under three inverted stirrups. Near to each end of the bar, a cylindrical hole is sunk from the upper surface of the bar to the depth of half an inch, and at the bottom of each cylindrical hole is a gold pin, upon which are cut three fine lines in the direction transversal to the bar, and two fine lines parallel to the axis of the bar. The limiting points of the yard measure are those points of the middle transversal lines which are midway between the longitudinal lines. On the upper surface of the bar, the following inscription is engraved,—

Copper	16 oz.
Tin	$2\frac{1}{2}$
Zinc	1

Mr. Baily's metal.
Standard Yard at 62.10, Fahrenheit, cast in 1845.
Troughton & Simms, London.

—It is necessary to observe that, although the bar was cast so long ago as 1845, the standard yard has been completed only very lately.

The standard pound weight is made of platinum, representing, when weighed *in vacuo* against the last Troy pound, 6,999·9975 grains,—of which the last standard contained 5,760 grains. The form of the weight is a cylinder, with a groove surrounding it a little above the middle of its height for the insertion of the fork which is used in lifting it. On the upper end of the cylinder is engraved the following inscription:—

No. 2
P. C.* 1831.
1 lb.

—The box containing the weight is mahogany,—and when its portions are screwed together, the weight is fixed immovably. This mahogany box is placed in a second mahogany box, the lid of which bears the inscription—

Standard Pound, 1853.

—The mahogany boxes of the yard and the pound are inclosed in an oak box, upon whose lid is cut and painted the inscription—

British Standards of Length and Weight, 1853.

* This means Parliamentary Copy.

INCORPORATED BY ROYAL CHARTER.

The Canadian Institute.

The proceedings of the Session of the Institute for the year 1853-4, will have commenced before the issue of the December number of the *Canadian Journal*. We therefore proceed to call the attention of members to certain regulations which have especial reference to the preliminary operations of the Society:—

1. The sessions of the Institute shall commence annually on the first Saturday in December; and ordinary meetings shall be held on every succeeding Saturday (omitting the Christmas holidays), until the first Saturday in April; but it shall be in the power of the Council to protract the sessions if it should seem necessary. The chair may be taken when five members are present.

2. The Annual General Meeting of the Institute shall be held on the third Saturday in December, at seven o'clock in the evening, to receive and deliberate upon the report of the Council on the state of the Institute, and to elect the officers and members of the Council for the ensuing year,

3. The Council shall draw up a yearly Report on the state of the Institute, in which shall be given an abstract of all the proceedings, and of the receipts and expenses of the past year to be accompanied by vouchers; and such report shall be read at the Annual General Meeting.

4. The President, First and Second Vice-Presidents, Treasurer, two Secretaries, and Curator and Librarian. (with six members to form a Council), shall be elected annually by ballot, at the general meeting on the third Saturday in December; and if that day fall upon a holiday, then upon the following Saturday.

5. That all persons to be eligible as officers of the Institute, and members of the Council must be put in nomination at the ordinary meeting immediately proceeding the annual general meeting.

6. Any member being nominated to an office and not elected thereto, shall be eligible to be elected as a member of the Council.

7, Every member voting at the annual election, shall deliver to two Scrutineers, appointed by the Chairman, a list containing the names of the persons he may be desirous of having elected as members of the Council for the ensuing year, specifying the offices for which he proposes them to be elected; the Scrutineers shall mark the name of every member so delivering his list, and if no valid objection be made, the same shall be accepted. *Votes of country members for the election of officers communicated in writing to the Secretaty shall be valid.*

8. Those members of the Institute residing at a distance from the city, shall have the power of forming themselves into Branch Societies for the purpose of holding meetings, and discussing scientific and other subjects; and are to be governed by the regulations of the Institute, and such other By-laws hereafter to be enacted by them and approved by the Council.

Museum of the Canadian Institute.

We have recently had the pleasure of examining a very handsome collection of fossils and Indian remains presented to the Museum of the Canadian Institute by George Bell, Esq., of Simcoe. The specimens number over one hundred and fifty, and among them are to be found some corals, madrepores, tubipores, and shells of great beauty, and in good state of preservation. Mr. Bell, in his communication to the Librarian and Curator of the Institute, states that, "the corniferous fossils have been found in various localities in the townships of Oneida, Walpole, Woodhouse and Townsend, and a few rolled species of stone in Windham and Charlotteville; but, as nearly all are characteistic, there is no doubt of their belonging to the same formation. I have heard a doubt expressed as to the Leptæna Depressa being found higher than the Niagara Limestone*; but about the specimens sent there can be no doubt, as they were all taken by myself from the rock *in situ*, part at Dover, and part five miles north of that place. I send also an Indian stone-axe and chisel, with a few arrow-heads and a singular perforated stone (probably a bead) from Charlotteville; also, some arrow-heads and fragments of pottery from Windham. The last are not good samples, but having some room to spare in the box, I put in a few pieces of such as I had at the time, expecting hereafter to get some better specimens."

Dr. Wilson, of Perth, has contributed an important addition to the Museum in the form of a fine selection of minerals, some being peculiar to Canada as far as is yet known of their distribution. Dr. Wilson's donation embraces twenty species, to many of which duplicates and triplicates are attached. This is an important item in the formation of a museum, as it permits exchanges to be made for unrepresented specimens.

We notice with particular pleasure these valuable contributions of Mr. Bell and Dr. Wilson; they will serve to attract attention to the magnificent science of geology, one which is second only to astronomy in the grandeur of its speculations and the imposing aspect of its present developments, and one which may vie with astronomy in its bearings upon the progress of the arts and the happiness of mankind.

* *Leptæna Depressa*, known also by the names *Strophomena Depressa*, *Productus Depressus*; is an exceedingly beautiful shell, strongly marked by undulations, crossed by striæ. We have found this shell at Woodstock in the Valley of the Thames. It is to be met with in the Clinton Group, and very abundantly in the Niagara Group, and certainly as high as the commencement of the Hamilton Group.—(*Ed. Can. Jour.*)

The Canadian Journal.

We direct the attention of subscribers to the advertisement of A. H. Armour & Co., which appears on the cover of the present number. The October number was delayed in its publication some days longer than might reasonably be attributed to the supplement which accompanied it. This was occasioned by the great inconvenience and delay with which the removal of Mr. Scobie's Printing Establishment to more commodious buildings was necessarily attended.

We have also to call the attention of Members of the Institute to the Circular which appears on the fourth page of the cover. It is earnestly hoped that the attendance of Members at the Annual General Meeting, on December 17th, will fully establish the expectations which the last annual conversazione orignated.

Robert Stephenson, M. P.*

The two new Engines constructed by Mr. Stephenson—the "Phœnix" and the "Arrow"—had a more extended flue surface than the "Rocket," and were subjected to a series of experiments resulting in further improvements; increasing the steam generating capacities of the boilers, simplifying the working parts of the engine, and materially increasing their power and speed. The twenty miles per hour of the "Rocket" was soon increased to fifty, and even to sixty miles per hour in some of its successors; and the Stephensons' Manufactory at Newcastle became the largest and most celebrated in existence, sending its products to the United States, and to all parts of the world where Railways were introduced.

Previous to the opening of the Liverpool and Manchester Railway in 1830, Robert Stephenson undertook the survey of the first line projected from London to Birmingham. This survey was commenced in October of that year, but so many important points for consideration presented themselves to him, that though the plans required by the then standing orders of Parliament were prepared and deposited by the end of November, yet by his advice the Bill was not then brought forward, in order that he might be afforded time for a more mature consideration of them. In pursuance of this determination, he devoted the greater part of the ensuing year to a minute examination of the country between London and Birmingham, and in the November of 1832 completed and deposited plans of the line in every important particular the same as it now stands.

In consequence, however, of the strenuous opposition made by the Grand Junction Canal Company and the land owners on the line, the Bill was thrown out by the Committe of the House of Lords. In the ensuing session, however, the same plans, with slight modifications, were again deposited, and after a hard Parliamentary struggle, the Bill received the Royal Assent in July, 1833.

The immense cost entailed upon the Railway Companies of the United Kingdom by the opposition to their charters offered by ignorant and interested parties both in and out of Parliament has, fortunately, no parallel in this or any other country. It is painful to reflect on, as it would be humiliating to record, the ignorant prejudices and cunning artifices by which the promoters and engineers of the great "Iron Ways" of Great Britain were thwarted in the commencement of their enterprises; instead of receiving with gratitude the great invention by which the public has been enabled at half fares to travel at four times the speed they had formerly attained, and whereby millions of tons of merchandize have similar advantages, the engineers engaged in locating the lines had every possible impediment placed in the way by the community they so much benefitted. In most cases these obstructions recoiled with disastrous effects on those who offered them, and in many instances the opposition offered by the inhabitants of country towns has prevented new life and vigour being infused into their dull and stagnant population by the facility afforded by Railway communication—nor is this all; the immense increase of cost per mile, which these Parliamentary struggles have caused, demand a corresponding increase in the tariff levied on the goods and passengers carried, and hence it follows that with an infinitely less amount of traffic on American lines, they yield a better profit with fares at two cents per mile, than English Roads with fares at double that rate. Much of this result is due to the enormous law costs of the English Roads; and it has been estimated that in the three years 1845, 1846 and 1847, upwards of ten millions sterling were wasted in Parliamentary enquiries and contests,—a sum sufficient to construct a complete system of railways in these Provinces—and it has also been asserted that previous to 1850, more than fifteen millions had been similarly wasted.

The proprietors having fought the bill through Parliament, the construction of the London and Birmingham line was commenced in June, 1834, and Mr. Stephenson having made arrangements with the directors to devote his time exclusively to the execution of the works on their line, he removed from the superintendence of the engine manufactory at Newcastle, and resided in London, where he applied himself assiduously to the accomplishment of his great undertaking—a portion of which, from London to Boxmoor, a distance of twenty four miles, was first opened; that from Boxmoor to Denbigh-Hall, twenty-one miles, was opened in the autumn of 1837; and from Birmingham to Rugby, twenty-one miles, was opened in 1838,—finally, the whole line was opened for public traffic on the 17th September in the same year.

Among the many difficult works on this line, the most prominent are the Blisworth cutting, the Tring cutting, and the Kilsby tunnel—all between Rugby and Denbigh Hall.

The Blisworth cutting, though not the longest on the line, was from the character of the material the most expensive. The Tring cutting contained the greatest quantity, but being of chalk, less difficulty was experienced than in the Blesworth, which consisted chiefly of hard, blue limestone, yielding at all seasons large quantities of water, which it was necessary to drain by pumping. The working of the rock in this cutting was rendered more difficult than it would have been, by the rock being interstratified by beds of blue shale, impervious to water, rendering every means of drawing it off except that of pumping, unavailable. The Blisworth cutting contained 1,200,000 cubic yards, and averaged 50 feet in depth for a distance of two miles. About 400,000 yards of the material was removed from each end to form adjoining embankments, which reached the height of 45 feet, and the remaining 400,000 yards were raised up the steep sides of the excavation, and deposited on the adjoining land in spoil banks. The cost of the excavation exceeded £200,000 sterling.

The Kilsby Hill was a still more formidable work than the last, for its execution was not only impeded by bad material and an immense flow of water; but the means for overcoming them were confined within the narrow limits of a tunnel. After the trial shafts had been sunk, the works were let by competition for the sum of £99,000 sterling, and were in busy progress when it was ascertained that at about 200 yards from the south end, there existed a thick quicksand, which the trial shafts on each side had just passed without touching. In view of this unforeseen difficulty, it became apparent that additional means beyond those already contemplated were necessary, and the contractor was in consequence relieved from his responsibility, the contemplation of which is said to have caused his death. So great indeed was the difficulty, that it became a question whether the execution of the Kilsby Tunnel should be abandoned or continued. Mr. Robert Stephenson, however, after mature reflection, offered to undertake the responsibility of continuing it, and he was authorized to do so. Extra shafts were sunk, and four powerful pumping engines were erected, which continued to pump from the quicksand for six months, with scarcely a day's intermission, at the rate of 1800 gallons of water per minute. By these means the difficulty of tunnelling was reduced, but still the operation was one of great difficulty and danger. On one occasion, those who were nearest the quicksand, in driving into the roof were almost overwhelmed by a deluge of water. A gang of workmen were sent to their assistance, with the requisite material on a raft in order if possible, while the utmost power of the engines were exerted, to close up a short length of the arch; the water rose,

* Continued from page 64.

however, with such rapidity that they were compelled to retreat, and were near being jammed against the crown of the tunnel. For a considerable time all the pumping apparatus appeared insufficient; so much so that the Directors almost determined to abandon it, but the perseverance of Stephenson prevailed, and he had at length the satisfaction of seeing the water recede before the power of his engines.

The tunnel is 2,400 yards in length, or nearly a mile and a half; it is 25 feet wide and 28 feet high, and is ventilated by two large shafts, each being 60 feet in diameter—one being 120 feet deep, and the other 90 feet; they effect so perfect a ventilation, that within a few minutes after the passage of a train, the smoke and vapour is carried off, so that the opposite end may be distinctly seen.

The time employed in constructing this stupendous work was thirty months; there were 36,000,000 of bricks used in it, and it cost £300,000—nearly three times what it would had the difficulties been of an ordinary character. This line of railway has eight tunnels of similar dimensions, that is 25 feet by 28 feet.

The most important bridge on the line is the Wolverton Viaduct, it is erected over the Ouse, near Stony Stratford, and consists of six semi Eliptical Arches, each 60 feet span, the roadway being elevated about 50 feet above the ordinary level of the Country. This Viaduct (except the coping which is of stone) is entirely composed of brick. The aggregate amount of excavation on the whole line amounted to about 15,000,000 of cubic yards, being equal to an average of 142,000 cubic yards per mile, and was completed in the short space of four years from its commencement.

The above figures indicate an expensive line, and accordingly we find that the favourable grades and curves have been obtained at a cost of about £42,000 per mile!

During the construction of the London and Birmingham line, the Belgian Government consulted Messrs. George and Robert Stephenson, as to the best system of railways to be adopted in that country. On their advice a cross of Trunk lines, extending from Ostend to Liege on the one hand, and on the other, from Antwerp through Brussels, to be connected with Mons and Valenciennes (making in all 347 miles) was adopted, and authorised by law in 1834. The Stephensons were both decorated by the King of the Belgians with the Ribbon and Cross of the Legion of Honor. These lines were completed and opened in 1844.

After completing the London and Birmingham line, Robert Stephenson, in conjunction with his Father, undertook the construction of various lines of railway, embracing a length of about 1800 miles, and for ten years were incessantly engaged in the Parliamentary Contests, originating the great net work of lines extending over all parts of the Kingdom.

The Birmingham and Derby, the North Midland, York and North Midland (to which the elder Stephenson chiefly devoted himself), the Manchester and Leeds, and the Northern and Eastern, were all constructed under Robert Stephenson and his Father; and during the same period the former as Chief Engineer, constructed the great Iron Cross of Roads which connect London with Berwick on the one hand, and Yarmouth with Holyhead on the other.

The York, Newcastle and Berwick line is one of the greatest of Stephenson's works, and in its length is the magnificent High Level Bridge over the Tyne, at Newcastle, and the beautiful Viaduct of twenty-eight arches of 125 feet in height, and 61 feet 6 inches span across the Broad Valley of the Tweed at Berwick, connecting the North British line with the York, Newcastle and Berwick, and completing a continuous railway route from London to Aberdeen.

Though not personally superintending his engine manufactory at Newcastle, Mr. Stephenson still continued to design and introduce various improvements into the locomotives there manufactured; amongst them the most important is the "Link Motion." It is probable that he was not the originator of this beautiful piece of mechanism, though it was first applied to his engines. Various arrangements of the valve-geering had been used for introducing the expansive action of steam, and for reversing the engine—while the working of the simple slide-valve was effected in almost as many different modes as there were makers of engines. Generally, their plans were so complicated as to cause very serious expense in maintaining them in repair, and the ordinary wear in so many working parts produced a derangement in the valves, necessarily resulting in a serious loss of power. It was therefore an important matter to simplify these parts, and still more important to preserve and improve the means of adjusting as circumstances required. the amount of expansive action given to the steam.

To Mr. John Gray is due the merit of the first application of the expansive principle by varying the travel of the valve, a principle of primary importance, though originally embodied in a complicated and inconvenient piece of geering.

Mr. Cabrey, of the North Midland Railway, accomplished the same effect in a more convenient form, and following up the same idea, Mr. Williams, at one time of Newcastle, suggested the germ of the link motion in a form, which, though rude and impracticable, still embodied the principle: and that principle, when further perfected, became in conjunction with the "lap" of the valve, the most important acquisition to the locomotive since the introduction of the blast-pipe and the multitubular flue.*

Since the application of the link motion to Stephenson's Engines in 1843, by Mr. Howe, but little has been done to improve its action—substitutes for the "link" have been proposed with no very tangible object except the saving of an eccentric—and though from not having been properly investigated, the correctness of its action has been denied by some; it has been gradually adopted by nearly all English manufacturers, and is now generally used by manufacturers in America.

No improvement has done more to economise the cost of working a railway than the introduction of the expansive principle into the Locomotive, and no contrivance so perfectly accomplishes that object as the "link motion."

* In order to exhibit the value of the lap of the valve, we introduce a tabular statement of the result of experiments made on the Liverpool and Manchester Railway, in 1842-'3, with a view to test the value of the changes made in the valves,—as affecting the consumption of fuel.

Gross consumption of Coke per mile.	
49 lbs.	average consumption of Company's Engines in the summer of 1839, with old Valve.
40 lbs.	average consumption of Company's Engines, after the introduction of the new mode of Coke deliveries,—old Valve.
36 lbs.	new Valves with ½ inch cap.
32 lbs.	new Valves with ¾ inch cap.
28 lbs.	new Valves with 1 inch cap, as applied to old steam and exhausting passages.
22 lbs.	same Valves and same Engines, with increased care in firing, so as to avoid all unnecessary waste of fuel.
15 lbs.	Valves with 1 inch cap, as applied to the new Engines, with enlarged exhausting passages, larger tubes, and closer fire bars, and greater accuracy of construction.

*Notices of Books.

Governor Christie aided us, by every means in his power, as well in procuring a fresh supply of provisions as in recommending to us the men best qualified to manage a canoe, and to guide us over the difficult and dangerous return route upon which we were about to enter.

While detained at the Assiniboin Colony by these preparations for our return, I had an opportunity of making a short visit, which interested me much, to a settlement of about five hundred Cree Indians, residing below the colony, at Prince Rupert's Landing. They are decidedly the most civilized tribe which I have seen or heard of in the North. These Indians support themselves mainly by the produce of their farms, which they cultivate with their own hands They dwell in comfortable squared log buildings, erected, thatched and white-washed by themselves. They are acquainted with the use of the simpler farming utensils, and the mechanical operations necessary to keep their farms and houses in order. Each family cultivates from five to ten acres of land, which is kept well fenced. They mow their own hay, and feed their cattle on it in the winter. A few occasionally hunt during a month or more in the summer, or when their crops do not require much attention; but this is more for recreation than for support. Some of the men occasionally contract with the Hudson Bay Company to transport their goods to and from York Factory, on Hudson's Bay.

The remarkable change in the habits and customs of these Indians has been wrought mainly through the force of example, by Mr. Smithhurst, who resides among them as missionary, and who is thoroughly conversant with their language. That gentleman is remarkable for his love of order and is devoted to agriculture and horticulture. His house is situated in the midst of a delightful little flower garden, kept in beautiful order, with flourishing fields of grain and meadows in the rear. The Indians, having continually before their eyes so pleasing and practical an example, of the comforts of a civilized life, as well as an illustration of the means by which, in a rigorous climate, they may be enabled to provide for themselves a support far more stable and certain than that derived from the chase, have gradually fallen into the habits of their instructor, and, by degrees have gathered around their permanent houses the implements and appurtenances, and even some of the comforts and luxuries belonging to the thrifty farmer, It is true they are sometimes accosted contemptuously by their neighbours, the Chippewas, and ridiculed as earth-worms and grubs: but they now retort upon them :—"Wait till the winter sets in, and then you will come to us, beggars for our surplus potatoes and indifferent peas."

The evening we were there, several young lads were engaged in sharpening their scythes, preparing to go out, next morning, in a party to mow.

The general agricultural character of the Red River country is excellent; the land is highly productive, especially in small grain. The principal drawbacks are occasional protracted droughts during the midsummer months, and, during the spring, freshets, which from time to time, overflow large tracts of low prairie, especially near the "Great Bend." Its tenacious subsoil insures its durability.

* * * * * * * * *

The Lake Superior country presents four principal varieties of soil: a drift-soil, similar in its ingredients to that just mentioned; a red clay and marly soil, prevalent over the high plains bordering on the coast, and the corresponding lands on the adjacent islands; a trap soil of limited extent, near the foot of the igneous outbursts, and finally, alluvial bottoms, which are confined exclusively to a small body of land on the east fork of Bad River.

The drift-soil prevails through the highlands, six hundred to one thousand feet above the level of the lake; also over the high grounds of the promontory, west of Chegwomigon Bay, at a height of three hundred to six hundred feet, and the higher points of the neighbouring Apostle Islands. These lands, owing to their inferior siliceous soil, and the abundance of erratic blocks disseminated over them, are hardly fit for cultivation.

The trap soils, which support a growth of sugar maple, oak, and other hard woods, are next in richness to the alluvial lands. They are found chiefly on high ridges and slopes, which, at the east and west ends of the district, are only a short distance from the lake shore; but on the waters of Bad River and the Brulé, they recede three-fourths of the distance back, towards the sources of their various branches.

With these trap soils of the Lake Superior country, may be classed the lands in the vicinity of Big Bull Falls, and south of Beaulieau's Rapids, on Wisconsin River; the Pokegoma country, bordering the lake of the same name in Minnesota, the immediate vicinity of the Falls of St. Croix, and a portion of the Snake, Kettle, and Little Rock River countries: since the soil of these localities originates from rocks of similar composition.

The red clay and marl lands, occupying the high plains skirting Lake Superior, are characterized particularly by the predominance of oxide of iron, from which they derive their colour, and which amounts to four and a half per cent., or nearly one half of the weight of the saline matter; it is always a retentive soil, from the abundance of argillaceous earth which enters into its composition, hence these red clay and marl lands are often wet, particularly when defended from the direct rays of the sun, by the dense growth of cedar, balsam, spruce, birch and hemlock that usually covers them. Still these lands are not so wet, but that by clearing and a judicious system of husbandry, they would soon become sufficiently dry for most kinds of crops and garden vegetables.

Lake Superior has, at times, not only the varied interest, but the sublimity of a true ocean. Its blue, cold, transparent waters, undisturbed by tides, lie, during a calm, motionless and glassy as those of any small secluded lake, reflecting with perfect truth of form and colour, the inverted landscape that slopes down to its smooth sandy beach. But when this inland sea is stirred by the rising tempest, the long sweep of its waves, and the curling-white caps that crest its surface, give warning not only to the light bark canoe, (still much used along its shores) but also to sloop and schooner and lake steamer, to seek some sheltering haven. At such times, craft of every description may be seen running before the wind, or beating up against it, all making for the most favourite harbour on the lake—the sheltered bay of Madeline Island.

As a site for a town, and especially as a place of resort for health and pleasure, La Pointe offers advantages beyond any portion of the mainland in Wisconsin. Its surface is sufficiently level and extensive for all purposes of agriculture; its soil, a retentive red marl, is capable, under a proper system of tillage, of returning to the husbandman a hundred-fold, and of producing fruits and vegetables in perfection. Its gently sloping and sandy beach, insures a secure footing to the bather. As a fishing station, it is unrivalled. The Bays and creeks of the numerous islands and main shore, distant only a few hour's run, are amongst the best fishing grounds on the whole lake, for trout, siscowet (*Percopsis Guttatus,*) and white fish or lake shad (*Corrgonus Albus.*)

Tempered as well in summer as in winter, by the vast expanse of water which surrounds it, and which, except at the immediate surface is almost always at 40° Fahrenheit, its climate is milder, at once, and more equable, than any part of Wisconsin, whether it be on the mainland of Lake Superior, or further south, on the Mississippi. Chiefly for this reason, but also on account of the bracing winds that sweep across the lake, Madeline island is probably not surpassed, in point of health, by any locality throughout the entire western country.

The prairie country, based on rocks belonging to the Devonian and Carboniferous systems, extending up the valleys of the Red Cedar, Iowa and Des Moines, as high as latitude 42° or 42°31′, presents a body of arable land, which taken as a whole, for richness in organic element, for amount of saline matter, and due admixture of earthly silicates, affords a combination that belongs only to the most fertile upland plains.

Throughout this district, the general levelness of the surface, uninterrupted only by gentle swells and moderate undulations, offers facilities for the introduction of all those aids which machinery is daily adding to diminish the labour of cultivation, and render easy and expeditious, the collection of an abundant harvest. There are, it is true, limited spots, less desirable for farming purposes, where the ground is liable to be overflowed by the adjacent streams, in times of freshets, and where local geological causes operate to alter the composition of the soil; or where, from too uniform a flatness of ground, near the sources of streams, water stagnates; these form, however, but a small fraction of the whole.

The greatest drawback to the settler in these portions of Iowa, is the limited extent of timber, which is chiefly found in belts and groves lining the borders of rivers, gradually diminishing in quantity, as a general rule, towards their heads. This disadvantage is in part counterbalanced by the ease with which a farm can be commenced and brought under cultivation.

Nevertheless, with proper economy and a little thought, an ample supply both of fuel and farming timber, may, in most instances, be insured. Again, the great extent of the coal district, throughout a large area of this prairie country, renders the consumption of timber for fuel unnecessary.

* Continued from page 80.

The portion of Iowa which is most deficient in timber is north of latitude 42°, especially on the dividing ridges. North of this latitude between the head waters of Three and Grand Rivers, there are distances of ten or fifteen miles without any timber; while between the waters of Grand River, the Nodoway, and the Nistinabotona, the open prairie is often twenty miles wide, without a bush to be seen higher than the wild indigo and the compass plant. The soil, too, in this region, is generally of inferior quality to that south of latitude 41° 30′.

After passing latitude 43° 30′, and approaching the southern confines of the Coteau des Prairies, a desolate, barren, knobby country commences, where the higher grounds are covered with gravel and erratic masses, supporting a scanty vegetation, while the vallies are either wet and marshy, or filled with numerous pools, ponds and lakes, the borders of which are inhabited by flocks of sandhill cranes, which fill the air with their doleful cries, and where the eye may often wander in every direction towards the horizon, without discovering even a faint outline of distant timber.

This description of country prevails for about three quarters of a degree of latitude, and between three and four degrees of longitude, embracing the water-shed where the northern branches of the Red Cedar, and the Iowa, and the eastern branches of the Des Moines, take their rise. After passing the extreme sources of the Mankota, the country again improves, both in quality of the soil and in the distribution of timber. On fairly entering the valley of the Minnesota River we again find a fertile, well watered, and desirable farming country. The second terrace of land bordering the Minnesota, may be especially cited for its fertility and advantageous position, elevated entirely above the highest freshets, and in proximity to a belt of forest which crosses the Minnesota about latitude 44° 30, and which is remarkable for its unusual body of timber, in a country otherwise but scantily supplied with wood.

The Crystal Palace at Sydenham.

The Crystal Palace rebuilding at Sydenham, is so far advanced that Messrs. Fox & Henderson have undertaken to surrender it to the company in a finished state at Christmas.

The following description of its proposed arrangements is interesting:—

The south-eastern end of the palace is so far finished that the plan of the interior decorations already begins to develop itself A large number of gardeners and their assistants have been for some time busily arranging plants and shrubs in beds and borders of different forms : and the statue of Charles II., which forms the most prominent object in this portion of the building, is now almost embowered in plants and flowers.

No less than 12,000 camelias and a proportionate number of geraniums, pelargoniums, with orange trees and other plants and shrubs, have been already arranged in this space. They are at present in pots, but the flooring will be cut away, according to the plans marked out, the beds filled up with mould, and the plants then transferred to their future destination. The centre will be occupied by a lake extending a considerable way up the nave, and here all kinds of aquatic plants will be placed. The site and extent of this inland sea are already indicated by the brickwork, and the points at which it will be spanned by light and elegant bridges marked out. The great subject of attraction at this end of the building at present, is what is termed the Pompeian Court—a *fac simile* of a building discovered when excavating the ruins of Pompeii. Here the visitor will have an opportunity of observing the style and character of Roman architecture and embellishments upwards of 1800 years ago, reproduced in all its most minute details, and with all its original richness and brilliancy of colouring.

The building is formed of an open court, with smaller apartments surrounding it. The centre is occupied by a fountain, and groups of richly gilt winged figures support the sloping roof, the emblematic paintings and ornaments being of the most graceful and delicate character. In the large apartment opening out from the central court, termed the peristyle, there are double ranges of columns enriched with paintings, and flowers and statues, niches for the Penates, or household gods, and other accessories show this to have been the state apartment in which visitors were received and the banquet spread. It is, however, at the north-western end of the building that the greatest progress has recently been made.

The first court nearest the central transept, is devoted to the illustration of ancient Egyptian and Assyrian architecture and decoration. It will, when completed, be approached from the central nave through a large gateway bordered with shrubs and flowers, and passing up through a long range of richly decorated columns, will disclose well-arranged groups of tombs, idols, sphynxes, and gigantic figures, one of which, seated, will be thirty or forty feet high. This court is much farther advanced than any other portion of the works, and is at present receiving its rich and brilliant colouring. Its superintendence and arrangement have been entrusted to the distinguished oriental traveller Bonomi.

Another step, and we pass to the perfected forms of the Greeks and Romans : and here, in a series of courts opening into each other, are placed statues and groups of figures, comprising casts from all the most celebrated works of the ancients. Among them are a large number of nude figures of Apollo, Baccus, Hercules, Jupiter, Athletæ Droscorodi, Satyrs, &c. On the opposite side of the nave, and next the terrace, is an Italian court, and one illustrative of the florid style of decoration which prevailed during what is called the Renaissance.

Beyond these is the mediæval court, which is considerably advanced, and which will exhibit specimens of Gothic architecture and decorations, many of the examples being taken from the old cathedrals of this country, and in connection with this will be a row of cloisters with quaint buttresses and groined roof, the whole forming a very perfect school for students and antiquarians Advancing still further, we reach courts which are to illustrate the details of Moorish architecture. The pillars of the Alhambra are just rising from the floor, and the outlines of the Court of Lions, with its great central fountain, the Hall of Justice and the other gorgeous illustrations of this luxurious Oriental style are only just developed.

Great changes are taking place in the exterior, the original design having been so far departed from or improved upon, that two wings proceeding from either extremity of the building, are now in the course of construction, with the object of affording additional space. One advantage gained by these wings will be, that they will mask the lofty forcing pumps. The terrace and gardens, notwithstanding the unfavourable state of the weather, have been considerably advanced, and large quantities of trees and shrubs have been planted. The wells have been sunk, pipes for the supply of water laid down, and steam engines for the purpose of working the pumps erected in remote parts of the grounds.

The flights of stone steps conducting from the grounds to the principal entrance have been decorated with sphynxes, and two large statues have just been completed for the terraces—one is by Monti, representing Italy, a female figure, crowned with turrets, and holding in one hand a laurel crown, and in the other implements connect d with the arts. The other is by Mr. J. Bell, and represents Australia, also a female figure, bearing a crook, and extending her left hand, filled with "nuggets" of native gold. She stands upon a rock, which is also veined with gold, and a kangaroo and its young crouch at her feet. These are only the commencement of a series of similar decorations and embellishments which are designed for the grounds, and during fine weather, the arrangements are such that recreation and instruction will be judiciously combined in the open air.

A very interesting department has its temporary location in a corner of the gardens near Annerley-road. This is the restoration or reconstruction of antediluvian monsters, under the superintendence of Mr. Waterhouse Hawkins, who has undertaken to place before visitors of the palace the gigantic animals and reptiles who peopled the earth before it became a fitting habitation for man. Among the inhabitants of "the world before the flood," who are to be resuscitated, are the labyrinthodon, a gigantic frog, upward of seven feet long—the plesiosaurus, an animal of the same species, with an enormous dragon's head and jaws.

The unwieldy megatherium, the iguanodon, and other huge reptiles will also be represented, and to render the illusion more complete, they will be placed upon two islands in the large reservoir, surrounded by the shrubs, ferns and brushwood which formed their habitats. The modern section of natural history is being proceeded with in a corner of the building, and many large and fierce animals, denizens of the tropical forests, are already prepared, in the act of crouching or springing on their prey.

A numerous population is rapidly springing up, or rather settling down, around the Crystal Palace—new roads are now being formed, private houses and villas erected, and taverns, coffee-houses and hotels starting up, as if by magic, in all directions

To the Editor of the Railway Gazette.

Ammonia in Rain Water, River Water, and Snow.*—Sir : As I conceive that one fact adduced on admitted authority will have more influence in the advancement of truth than a volume of demonstrative reasoning, I am induced, in reference to the papers which appeared in the *Mining Journal* of 1849 and 1851, to trouble you with the results obtained by M. Boussingault, of the French Institute. "It appears that the greatest quantity of Ammonia is contained in rain water. Some that had fallen on the roof of the Paris Observatory yielded four milligrammes in the French litre; while the water of the rivers does not contain 1-10th milligramme in the same quantity. That snow gathered after lying 36 hours on some fields, yielded ten times more Ammonia than that gathered immediately after it had fallen." That the softness of rain water is referable to Ammonia has long been admitted; but, until the appearance of my papers, it was conceived that this quality was acquired from the atmosphere. It is, therefore, much to be regretted that no reference is made to the relative proportion of Ammonia in rain and snow water, or such information could not have failed in throwing much light on one of Nature's most important operations—a deficiency, it is hoped, the *savans* on this side of the Channel will make good during the coming winter; and it is also to be hoped they will be induced to inquire into the *cause* of the startling fact, that snow 36 hours' old should be so much more Ammoniacal than that just fallen—it being reasonably to be inferred that this increase is not acquired from the soil, since rain, in its passage through the earth, *parts* with its Ammonia at all periods of the year. The course I suspect to be purely electrical; and if it should so happen that the Ammonia of the just-fallen snow corresponds in amount to that of rain, we shall have acquired evidence of the very simple means by which the Creator ensures to the northern regions a supply of this essential to the production of nitrogenous matter. This is unquestionably the decomposing era of the earth's *present* cycle in the creation; and, in reference to the second paragraph of Mr. Ennor's letter of the 3rd inst., I beg his attention to the fact, that Ammonia, like Lime, is a solvent of the mineral kingdom, and that snow is mostly deposited on the tops of hills or mountains, where its ammonia and water would have a levelling influence. Reckless of the consequences, we persist, year after year, in adding to the earth's surface by combustion, at least 60,000,000 tons of carbon, thereby causing the evolution of thousands of millions of *tons* of gases that cannot fail in producing a most powerful influence on both the atmosphere and earth; and cholera, influenza, potato, &c., disease, deluges of rain, and "strikes," are the fruits. Surely, then, the evidence afforded by M. Boussingault will induce at least an enquiry.

FRANKLIN COXWORTHY,
Author of "Electrical Condition."

Maresfield, Sussex, Oct. 17, 1853.

LOCOMOTION BY COMPRESSED AIR.—The obstacles which have till now opposed the employment of the expansive force of compressed air will, it is thought, disappear, through the process of M. Juliene, which consists simply in compressing air by means of an hydraulic press. By this method, M. Juliene substitutes for the solid piston—which a grain of sand may alter, which the slightest irregularity in the pump would throw out of action, and which becomes heated by friction—a liquid piston, not less incompressible than the other, filling always exactly the space in which it moves, be it regular or not, and acting by progression on a resistatce so exactly calculated, that this proportion, although increasing, is always in relation to the force to be overcome. The air is thus compressed at 30 atmospheres in iron bottles, which are about 4 millimetres thick. it is perfectly preserved under this pressure; and it was with a bottle of this kind that M. Juliene put in action a small vehicle, carrying two persons, and moving with great rapidity.—*American Journal.*

ARTIFICIAL PRODUCTION OF DIAMOND POWDER.—Some considerable sensation has been produced in the scientific circles of Paris by the announcement of the artificial formation of diamond powder. M. Despretz has made two communications to the Academie des Sciences upon carbon. In these he states that placing at one, the inferior, pole of a voltaic battery a cylinder of pure charcoal(its purity being secured by preparing it from crystalised white sugar candy), and at the superior pole a bundle of fine platinum wires so arranged that the charcoal was in the red portion of the electric arc, and the plantinum in the violet,—he found the carbon volatilised, and collected on the plantinum wires in a changed state. In these experiments the current has been continued during a month in activity, and the powder collected on the wires has been found to be sufficiently hard to polish rubies with great rapidity, and when burnt it left no residue. M. Despretz asks himself,—Have I obtained crystals of carbon, which I can separate and weigh, in which I can determine the index of refraction and the angle of polarisation without doubt? No; I have simply produced by the electric arc, and by weak voltaic currents, carbon crystalised in *black octohedrons*, in *colourless and translucent octohedrons, in plates* also *colourless and translucent*, which possess the hardness of the powder of the diamond, and which disappear in combustion, without any sensible residue.—A similar result has been obtained by decomposing a mixture of chloride of carbon and alcohol by weak galvanic currents. The black powder deposited was found to possess equal hardness with that which was sublimed, and rubies were readily polished by it. A few years since, graphite and coke were formed from diamonds: we now appear to be advancing near towards the conversion of graphite and coke into diamonds.

ARTIFICIAL PEARLS.—An oyster, or rather a water muscle, in which the artificial pearls are formed by the Chinese, has recently been sent to this country. These pearls are only obtained near Ning-po, and until lately very little was known of the manner in which they were formed. The *Hermes* steamer, however, on a late visit to that place, was able to obtain several live ones, in which, on being opened, several pearls, as many as 18 or 20, were found in the course of formation. The one sent only contains simple pearls adhering to the shell. It appears they are formed by introducing small pieces of wood, or baked earth, into the animal while alive, which, irritating it, causes it to cover the extraneous substance with a pearly deposit. Little figures made of metal are frequently introduced, and when covered with the deposit, are valued by the Chinese as charms. These figures generally represent Buddha, in the sitting posture in which that image is most frequently pourtrayed. Several specimens have, it is said, been preserved alive in spirits, and others slightly opened, so as to show the pearls. The society has reason to believe that it will shortly receive a more detailed statement, accompanied with specimens, in reference to this interesting fact.—*Jouanal of the Society of Arts.*

DEEP SEA SOUNDINGS.—A brig of war, bearing the stars and stripes of the United States at her masthead, is now lying in the Southampton waters, and engaging the attention of practical and scientific men. She is called the Dolphin; and her object in the Atlantic is to procure the data desired by Congress for the use of Lieut. Maury. She left Chesapeake Bay 3 months ago. Her first task was, to strike a line from that bay to Rockule, on the west coast of Scotland, and take soundings at intervals of 100 miles along it. From Rockule, a second line was run to the Azores; a little to the north of which a ridge, 6,000 feet in height from the ocean bed, was discovered,—the soil on this elevation being a fine yellow chalky substance, mixed with fine sand. From the Azores the explorer made a westerly cut,—everywhere finding bottom and everywhere noting the set of tides and currents, and the temperature of the water. The Dolphin next steered for the Three Chimnies, where she found bottom at a depth of 1900 fathoms. The greatest depth of water was found in lat. 41° to 43°, long. 51° to 56°,—where the line fell out 3,130 fathoms. In a few days the Dolphin will have completed her outfit,—when she will make for the western side of the Azores, and pursue this series of important discoveries. The Dolphin is admirably fitted up for her work, and her sounding apparatus is the finest ever seen in Europe. Hitherto a continuous series of soundings in deep water has been rendered difficult by the fact of each sounding costing the ship a fresh line; however strongly the line was made, when once out it has never been recovered. The Americans have invented a mode by which the weight on touching the bottom is detached,—so that the line may be drawn back with ease. We borrow from the *Daily News* an account of this ingenious contrivance:—"A hole is drilled through a 64 lb. or heavier shot, sufficiently large to admit a rod about three quarters of an inch in diameter. This rod is about 12 or 14 inches in length, and with the exception of about 1½ inch at the bottom, perfectly solid. At the top of the rod are two arms extending one from each side. These arms being upon easily acting hinges, are capable of being raised or lowered with very little power. A small branch extends from the outside of each of them, which is for the purpose of holding by means of rings a piece of wire by which the ball is swung to the rod. A piece of rope is then attached by each end to the arms, to which again is joined the sounding-line. The ball is then lowered into the water, and upon reaching the bottom the strain upon the line ceases, and the arms fall down, allowing the ball to detatch itself entirely from the rod, which is then easily drawn in,—the drilled portion of which is discovered to be filled with a specimen of that which it has come in contact with at the bottom." With this apparatus, aided by the hosts of assistants whom Lieut. Maury's visit to Europe will doubtless bring to the great work of exploration, the ocean bed may become in time as well known to us as the bed of the Thames or that of the Hudson.

NEW DIBBLING MACHINE.—Mr. Thomas Revis, of Stockwell, has just specified, under Letters Patent granted to him, for "improved single-seed drilling or dibbling machinery." In this specification, he sets forth the following description of his apparatus, which has been tried, and found to effect the desired object so well that single grains of wheat have been deposited in the ground, and produced giant straw, and ears corresponding thereto both in number and size:—My invention consists in, or has reference to, improved drilling or dibbling machinery for planting seed singly, or one at a time. The droppers for dropping the seed singly are made to act by means of a lever, or lifter, having its head, or handle, near to the handle of the dibble, and by this means the mouth of the droppers will be opened just wide enough to deposit a single seed, whilst by this arrangement of the handles, the operator can hold and work the dibbler with the same hand, which will enable him to use two dibblers at one and the same time—that is, one in each hand. In this case, the lever, or lifter, aforesaid acts by suitable mechanism, so as to allow only a single seed to issue from the mouth of the dibbler at one time; the tubes of the dibblers are to be made in parts, attached together as hereafter set forth; the funnel, or reservoir, designed to hold the seed being on the top of the tube. The two irons, or handles, called the lifting and holding-irons, are secured to the tube, and extend and pass through the top of the funnel. The tubes being made in halves, I have two pieces of metal (or other suitable material), one for each half of the tube, of a shape corresponding with the size of the inner circle of the tube; these pieces of metal are placed exactly opposite each other in the tube, flush with the top of it, and secured firmly to the tube; the piece intended for the side of the lifting-iron is designated the "receiver," and has a cavity formed thereon to receive the seed, and this cavity thus formed is left very smooth; the other piece of metal should be placed exactly opposite, in the other half tube of the holding-iron, and which is denominated the "strike," as it performs the office of keeping back the overplus seed on the return of the lifting-iron. It should be borne in mind, that in most cases of single deposits the seed should be sifted, that as uniform a size as possible may be obtained. In the case of wheat-sowing, or planting, I prefer to make the cavity of an oblong shape, and somewhat larger or deepened at the bottom, in order to adapt it to the shape of the grain. It is obvious the above-described mechanism may be adapted (a number combined together) to machine drills.—*Mining Gazette.*

Monthly Meteorological Register, at the Provincial Magnetical Observatory, Toronto, Canada West.—October, 1853.

Latitude 43 *deg.* 39.4 *min. North. Longitude,* 79 *deg.* 21 *min. West. Elevation above Lake Ontario :* 108 *feet.*

Magnet.	Day.	Barom. at tem. of 32 deg.				Temperature of the air.				Tension of Vapour.				Humidity of Air.				Wind.				Rain in Inch.	S'nw in Inch.
		6 A.M.	2 P.M.	10 P.M.	MEAN.	6A.M.	2P.M.	10P.M.	M'N.	6A.M.	2P.M.	10P.M.	M'N	6 A.M.	2 P.M.	10 P.M.	M'N.	6 A.M.	2 P.M.	10 P.M.	M'N V		
						°	°	°	°												Miles		
c	1	29.512	29 446	29.374	29.443	46 5	58.2	53.9	52.80	0.240	0.264	0 374	0.28	77	55	91	74	N b E	S	S	3.01	0.085	- -
a	2	.456	.539			46.5	49.2			.263	.221			84	64			N W b W	N W b N		8.33	- -	- -
b	3	.662	.597	.664	.649	34.7	49.7	42.5	42 85	.170	.131	.236	.184	85	37	88	70	N W b W	W b N	W S W	3.79	Inap	- -
b	4	.531	.397	.276	.390	47.8	64 7	57.7	57 07	.241	.343	.349	.313	73	57	75	68	S S W	S S W	S b W	8.29	0.150	- -
b	5	.041	.019	.259	.115	55.8	57.1	48.7	53.20	.355	.351	.274	.32	81	77	81	82	S b W	W b N	W N W	9.11	0 215	- -
b	6	.564	.673	.783	.687	41.2	45.6	32.1	39.48	.197	.174	.151	.171	76	57	83	71	N W b W	N W	W b N	5 60	Inap	- -
b	7	.875	.798	.696	.786	28.7	49.5	43.8	41.63	.127	.247	.243	.207	80	71	86	77	N W	S S E	Calm	3 70	- -	- -
c	8	.652	.423	.270	.428	35.5	58.6	56.1	51.55	.192	.331	.357	.290	93	68	81	81	Calm	S b E	S b W	4.73	- -	- -
b	9	.373	.205			42.7	61.7			.242	.275			90	51			Calm	W b S		6.33	- -	- -
b	10	.411	.480	.613	.519	33.4	46.6	37.3	38.80	.157	.198	.177	.166	82	63	80	71	W	S b W	N W	5 22	0.050	- -
a	11	.790	.826	.870	.834	34.6	48.3	33.7	39.12	.164	.172	.162	.165	82	51	83	71	N W	N W b N	W	5.65	- -	- -
b	12	.836	.773	.752	.779	36.3	52.1	39.5	42 07	.169	.188	.176	.175	79	49	73	67	W b N	W b N	W b N	4.29	- -	- -
b	13	.762	.732	.798	.763	34 8	56.4	41.0	44.70	.162	.195	.195	.18	78	43	76	66	W b S	N W	N N W	6.23	- -	- -
d	14	.871	.892	.929	.906	36.4	54 7	40.0	43.58	.188	.206	.163	.200	87	49	66	71	N W b N	S b W	N	3.61	- -	- -
c	15	.968	.907	.890	.917	34.8	56 5	43.5	44.83	.168	.270	.196	.216	84	61	70	73	N W b W	S	S b W	2.93	- -	- -
c	16	.915	.910			34.1	57.4			.158	.326			79	71			S b W	S E		1.14	- -	-
b	17	.790	.763	.867	.809	41.6	60.7	48.0	50.45	.224	.334	.215	.269	86	64	65	73	N b E	S	N	3.80	- -	- -
c	18	.941	.951	.933	.944	39.3	50.9	34.4	42.00	.196	.227	.156	.189	82	62	78	71	N	S S E	Calm	2.18	- -	- -
b	19	.930	.901	.891	.912	31.8	58.2	43 5	44.80	.145	.251	.198	.211	81	55	71	70	Calm	S	Calm	0.79	- -	- -
a	20	.884	.796	.705	.788	39.1	58.6	48 7	49.00	.205	.278	.215	.223	87	57	63	66	Calm	S E b E	N N E	1.25	- -	- -
b	21	.607	.458	.305	.444	50.6	55 9	55.4	54 07	322	.365	.395	.364	89	84	92	89	Calm	N E b E	E N E	7.60	0.005	- -
a	22	.130	.093	.201	.155	57.4	57.9	53.5	55.55	.423	.387	.336	.374	92	82	84	86	N E b E	S b W	S W b S	7 45	0.020	- -
c	23	.434	.482			38.4	48 4			.180	.260			78	78			S W b W	W b S		6 55	Inap	- -
e	24	.667	.525	.429	542	28.7	39.0	31.1	32.95	.143	.169	.128	.152	90	72	73	80	W S W	N N E	W b N	2 42	- -	- -
e	25	.342	.513	.680	.525	25 5	38.1	34.5	32.70	.107	.155	.171	.142	76	68	87	76	W	S W b W	Calm	7.23	- -	Inap
b	26	.692	.589	.474	.578	37.3	46.5	43.8	43.10	.193	.230	.255	.23	87	74	91	86	S	S b W	S S E	5 53	0 350	- -
b	27	.451	.537	.652	.570	44.2	48.3	39 5	44.32	.268	.239	.213	.23	93	72	88	82	Calm	N	Calm	5.53	- -	- -
a	28	.658	.719	.816	.742	37.0	43.8	33.0	38.32	.182	.143	.152	.159	83	51	87	70	N E b N	N	N N W	3 53	- -	- -
a	29	.956	.992	30.061	30.014	35 2	41.9	30.2	34.93	.167	.189	.132	.15	82	72	78	76	N W b N	S b W	N b E	3.18	- -	- -
d	30	30.049	29 920			30.2	43.8			.145	.197			86	70			N N E	S E b E		2 31	- -	nap
b	31	29.752	.618	29.526	29.623	28.7	50.1	44 5	41.40	.146	.216	.245	.20	93	61	85	80	E N E	S	S	7.14	- -	- -
	M	29.664	29 633	29.643	29.649	33.34	51.84	42.70	44.40	0 202	0.241	0.226	0.223	84	62	80	75	Ml's 3.45	Ml's 7.85	Ml's 5 95	4.72	0.875	

Sum of the Atmospheric Current, in miles, resolved into the four Cardinal directions.

North, 1162.29 ; West, 1731.38 ; South, 1217.07 ; East, 402.64.
Mean direction of the wind, West.
Mean velocity of the wind - - 4.72 miles per hour.
Maximum velocity- - - - - 17.1 miles per hour, from 9 to 10 a.m. on 25th
Most windy day - - - - - 5th: Mean velocity, 9.11 miles per hour.
Least windy day - - - - - 19th Mean velocity, 0.79 ditto.
Raining 23.5 hours on 10 days.
Thunderstorm on 5th, from 11 A. M. to Noon.
Snowing on 2 days. Snowing 3 hours, quantity Inapp.
First frost of the season, 12th Sept. First snow of the season, 25th Oct.
Indian Summer from 12th to 20th October.
Highest Barometer - - 30.066, at Midnight on 29th. } Monthly range:
Lowest Barometer - - 28.985, at Noon on 5th. } 1.081 inches.
Highest regist'd Temp. - 64.7, at 2 P.M., on 4th } Monthly range.
Lowest regist'd Temp. - 23.4, at — A.M., on 30th } 41.3
Mean Maximum Thermometer - - - 53 34 } Mean daily range:
Mean Minimum Thermometer - - - - - 32 83 } 20.51
Greatest daily range - - - - - 31.5 from P. M. 9th to A. M. of 10th.
Warmest day - - 4th - - - Mean Temperature - 57.07 } Difference
Coldest day - - - 25th - - - Mean Temperature - 32.70 } 24.37

The "Means" are derived from six observations daily, viz., at 6 and 8 A. M., and 2, 4, 10 and 12, P. M.

Aurora observed on 4 nights. Possible to see Aurora on 16 nights. Impossible to see Aurora on 11 nights.

The column headed "Magnet" is an attempt to distinguish the character of each day, as regards the frequency or extent of the fluctuations of the Magnetic declination, indicated by the self-registering instruments at Toronto. The classification is, to some extent, arbitrary, and may require future modification, but has been found tolerably definite as far as applied. It is as follows:

(*a*) A marked absence of Magnetical disturbance.
(*b*) Unimportant movements, not to be called disturbance.
(*c*) Marked disturbance—whether shewn by frequency or amount of deviation from the normal curve—but of no great importance.
(*d*) A greater degree of disturbance—but not of long continuance.
(*e*) Considerable disturbance—lasting more or less the whole day.
(*f*) A Magnetical disturbance of the first class.

The day is reckoned from noon to noon. If two letters are placed, the first applies to the earlier, the latter to the later part of the trace. Although the Declination is particularly referred to, it rarely happens that the same terms are not applicable to the changes of the Horizontal Force also.

Comparative Table for October.

Year.	Temperature.				Rain.		Snow.		Wind. Force.
	Mean.	Max. obs'rvd	Min. obs'rvd	Range.	D'ys	Inches.	Dy's	Inch	Velocity
	°	°	°	°					Miles.
1840	44.4	68.5	23.9	44.6	13	1.860	3	not	-
1841	41.6	58.3	29.3	38.0	6	1.360	2	rec'd	--
1842	45 1	68.5	30.0	38 5	8	5.175	0	"	--
1843	41.8	65.7	24 5	41 2	12	3.790	4	2 5	0.54lb.
1844	43.3	69.6	17.8	51.8	7	imperfect	4	12·0	0.43lb.
1845	46.4	62.7	20.0	42 7	11	1.760	1	Innp.	0.26lb.
1846	41.6	69.7	20.7	49.0	14	4.180	2	Inap.	0.44lb.
1847	44.0	65.0	20.3	44.7	13	4.390	2	Inap.	0.19lb.
1848	46 3	62.2	26.4	35.8	11	1 550	0	none.	4 60m.
1849	45.3	59 2	25.5	33.7	13	5 965	1	Inap.	4.76m.
1850	45 4	66.6	24.8	41.8	10	2 085	0	none.	5.30m.
1851	47.4	66.1	25 0	41.1	10	1.680	2	0 3	4.39m.
1852	48.0	70.7	29.8	40.9	12	5.280	0	none.	4.47m.
1853	44.4	64.7	25.5	39 2	10	0.875	2	Inap.	4 72m.
Mean	41 86	65.53	23.89	41.64	10.7	3.073	1.6	1.3	0.37 lbs 4.71 M'l