persons to the square mile. In 1801, the people of England were on an average 153 yards asunder, in 1851 only 107 yards. The mean distance between their houses in 1801 was 362 yards, in 1851 only 252 yards. In London the mean proximity in 1801 was 21 yards, in 1851 only 14 yards. The number of islands in the British group were stated at 500, but inhabitants were only found on 175 on the day of the census. The early history of the more celebrated of the islands was given. The population of the chief of the group, Great Britain, had been given. Ireland contained 6,553 357 inhabitants; Anglesey, the next most populous island, had 57,318 inhabitants; Jersey, 57,020; the Isle of Man, 52,344; the Isle of Wight, 50, 24; Guernsey, 29 757; eight islands ranged from 22,918 to 5,857, 17 from 4 006 to 1,061, 52 from 947 to 105, and the remaining 92 downwards to an island inhabited by one solitary man. The shires, hundreds, and tythings, were traced to Alfred the Great; the circuits to Henry the Second. The terms "hundreds" and "tythings" had their origin in a system of numeration. The number of reformed boroughs in England and Wales were 196, and contained a population of 4,345,269 inhabitants. Scotland contained 83 royal and municipal burghs, having a population of 752,777 inhabitants. The difficulty of tracing the boundaries of the *ecclesiastical* districts, and consequently of ascertaining correctly their population, was shown. The changes in the ancient boundaries of counties and other divisions were alluded to, and the paper concluded with a general summary of the results of the census. An appendix contained tables, showing the population and number of houses, distinguishing whether inhabited, uninhabited, or building, in England, Scotland, Wales, and the Islands, respectively, at each census from 1801 to 1851; the same in 1851, for each of the 14 registration divisions; for each of the 36 districts of London; and for each county in England and Wales, and in Scotland; also the population of each county in England and Wales, and in Scotland, at each census from 1801 to 1851, and the increase of population in the last half century; the area in acres and square miles, the number of persons to a square mile, of acres to a person, of inhabited houses to a square mile, and of persons to a house, for each county in England and Wales, and in Scotland; the population and number of inhabited houses in the counties, and parliamentary divisions of counties, in England and Wales, and in the counties of Scotland, including and excluding represented cities and boroughs or burghs, also the number of members returned: the population of each island containing above 100 persons; the population and number of inhabited houses in each of the 815 cities, boroughs, and principal towns in England and Wales and in Scotland, distinguishing the municipal and parliamentary limits; the number of each class of public institutions in England and Wales, Scotland, and the Islands, and the number of persons inhabiting them; the number of births and deaths, and the excess of births over deaths, in England and Wales, for each of the ten years of 1841–50; and finally, the number of persons who had emigrated from Great Britain and Ireland in each year from 1843 to 1852 inclusive and the destination of the emigrants. The author concluded by stating that the paper would be immediately printed.

SECTION G.—MECHANICAL SCIENCE

'*Introductory Address on General Improvements in Mechanical Science During the Past Year*,' *by* W. FAIRBAIRN.—The first subject noticed by Mr. Fairbairn was Ericsson's Caloric Engine, from which so much had been expected. It was constructed, he said, on the same principle as the air engine of Dr. Stirling, invented ten years ago:—the engine is passed through wire gauze to take up the heat, instead of through plates of iron. The great objection to the engine appeared to be that two-thirds of the power was wasted in passing the air through the gauze; and though it may be premature to pronounce an opinion before the result of the improvements lately effected were known, yet if so much of the power was required for taking up the heat, Mr. Fairbairn could not but think it must prove a wasteful expenditure of fuel. The improvements that during the last year had been made in the application of the screw propeller were opening a new era in the history of our war and mercantile navy, of which the recent review at Spithead might be considered an indication. We were now in a state of transition between the paddle and the screw, and he had no doubt that in progress of time great improvements would be made in the construction of the engines, and their applicability to the work, which would materially economize space and power in our steam vessels. Mr. Fairbairn next alluded to the construction of an immense steam vessel, which had been undertaken by Mr. Brunel and Mr. Scott Russell, of such vast dimensions that it would stretch over two of the largest waves of the Atlantic, and would thus obtain a steadiness of motion, which would be a preventive against sea sickness. This mammoth steamer is to be 680 feet long, with a breadth of beam of 83 feet and a depth of 58 feet. The combined power of the engines would be that of 2,600 horses. The ship is to be built of iron with a double bottom of cellular construction, reaching six feet above the water line, and with a double deck, the upper and the lower parts being connected together on the principle of the Britannia tubular bridge, so that the ship will be a complete beam. It would thus possess the strength of that form of construction, and not be liable to "hogg" or break its back as had been the case with other ships of great length. The double bottom would be a means of increased safety in other ways, for if by any accident the outer shell were broken, the inner one would prove effectual to keep out the water.—As an additional security, however, it was divided into ten water-tight compartments. The ship would be propelled by paddles and by a screw, which would be worked by separate sets of engines, so that if any accident occurred to the machinery of one, the other would be in reserve. He said he had no doubt that if properly constructed, this ship would answer the expectations entertained of its capabilities and strength, and that it would form, when completed, the most extensive work of naval architecture that had ever been constructed. The next subject to which Mr. Fairbairn adverted, was the improvements making in the locomotive department of railways, particularly to an engine constructed for the southern division of the North-Western Railway, from the designs of Mr. McConnell, which was the most powerful locomotive that had yet been made for the narrow gauge. The peculiarity of construction consisted in the great length given to the fire-box, in which the greatest amount of steam always generated, and in the comparative shortness of the tubes, which were only half the usual length. The steam generated by this boiler was sufficient for any engine of 700 horse power. The engine was intended for an express train that would complete the distance from London to Birmingham in two hours. In manufacturing machinery there had also been great activity and progress during the past year; and it was gratifying, Mr. Fairbairn observed, to find accompanying this improvement in machinery a most prosperous condition in the working classes engaged in those manufactures—a prosperity which had never been equalled within his experience. He attributed this prosperous state of things to the combined operations of improvements in machinery and the removal of commercial restrictions. The improvement which he more especially noticed was that of a new combing machine of French invention applicable alike to cotton, to flax, and to wool. It combs the fibre instead of carding it, a number of small combs being applied in succession to the cotton or flax, by which means a much finer yarn can be produced from the same material than is possible by the former processes. As evidence of the present activity and enterprise in manufacturing industry, Mr. Fairbairn mentioned the erection of a mammoth alpaca woollen manufactory, by Mr. Salt, of Saltaire, near Bradford, which was 550 feet long, 50 feet wide, and six stories high, besides offices, warehouses, and various other buildings connected with it. Their steam engines to drive the machinery would be equal to 1,200 horse power, and the factory would employ upwards of 3,000 hands. The cost of the whole would be upwards of £300,000, and the enterprise was that of a single individual. Mr Fairbairn concluded his *resume* of manufacturing progress by noticing the improvements introduced by Prof. Crace Calvert, of Manchester, in process of melting iron by previously removing the sulphureous vapour from coal and smoke. The results had proved most satisfactory, the strength of the iron produced by this process being about 40 per cent. greater than that made in the ordinary way.

'*Report of the Committee appointed in* 1852 *to prepare a Memorial to the Honourable East India Company, on the Means of Cooling Air in Tropical Climates*,' *by* W. J. MACQUORN RANKINE.—In the absence of Mr. Rankine, one of the Secretaries read the Report, which was founded on experiments with apparatus invented by Prof. Smyth, described by him at a previous meeting of the Association. The principle of the invention consists in cooling the air by expansion. The air at the temperature of the atmosphere is first compressed in a bell receiver, and the heat generated by this compression is lowered by passing the air through a number of tubes immersed in water, by which means it acquires in its compressed state the normal temperature of the atmosphere—say 90° of Fahrenheit. The air then passes into another inverted bell receiver, where it is expanded to the ordinary pressure of the atmosphere, and during this expansion, it absorbs so much heat that the temperature is reduced to 60°. It is then admitted into the room to be ventilated. The compression of the air during the experiments in the first cylinder was equal to 3 2-10 inches of mercury per square inch above the pressure of the atmosphere, and the refrigerator exposed a cooling surface of 1,100 square feet, which was considered sufficient to reduce the temperature of the air in passing through the tubes to that of the atmosphere, viz. 90°. The Report stated that by means of this apparatus, 66,000 cubic feet of air per hour might be cooled from 90° to 60°, by a steam-engine of one-horse power which is required to raise and depress the bell receiver. The advantage of cooling the air by mechanical means instead of by evaporation was stated to be, the avoidance of aqueous vapour with which the air is injuriously charged by the evaporating process.