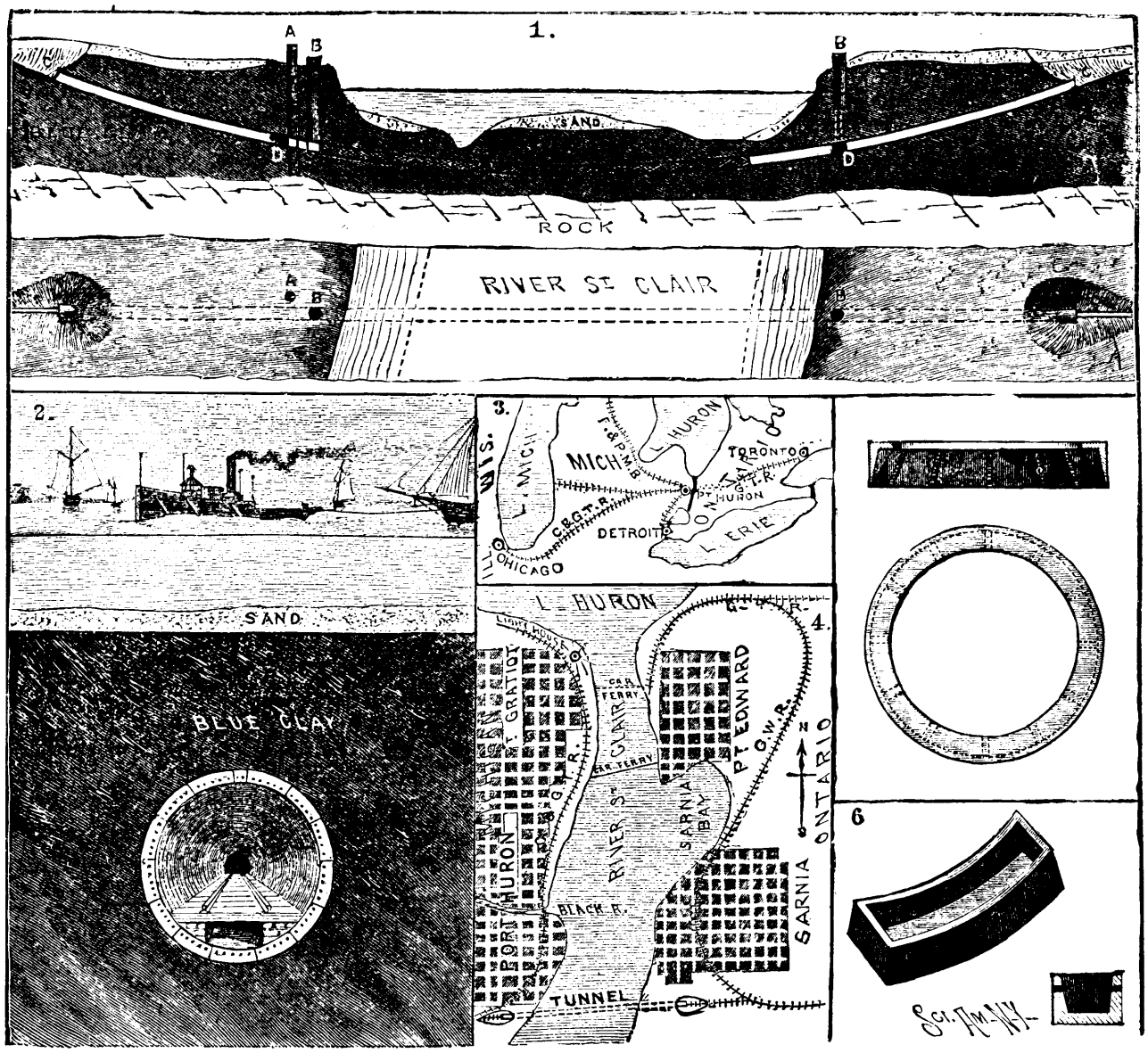
THE ST. CLAIR RIVER TUNNEL.

THE formal opening of the St. Clair River Railway Tunnel on September 19th marked the successful termination of one of the most important engineering projects that has lately attracted attention on this continent. It not only affords a new and better highway of traffic between Canada and the United States at that point, but it establishes the possibility of such a work being constructed anywhere under similar conditions with safety and economy. To a Canadian engineer, Mr. Joseph Hobson, is due the honour of having planned and carried out the work. He was the architect, designer and builder, and though his confidence in the feasibility of the scheme was not at the outset shared by engineers generally the event has fully justified his forecast. That Sir Henry Tyler, himself an engineer as well as president of the Grand Trunk Railway, agreed with Mr. Hobson's views, of course contributed greatly to strengthen the confidence of the great corporation in the accuracy of the latter's estimate of the work.

The St. Clair Tunnel Company was formed in the year 1886, and work upon the great cuttings on either side was begun in January, 1889. Work upon the tunnel proper was begun in August of the latter year, and in August, 1890, Mr. Hobson had the pleasure of breaking down the last thin wall that separated the workmen on either side, and the tunnel was open. On the 24th of December the last stones of the portals of heavy masonry were laid and the tunnel was complete. The work on the approaches has since been finished, and on September 19th of the present year the formal opening took place. On that day a splendid special train, with Sir Henry Tyler, accompanied by directors of the Grand Trunk Railway and distinguished guests from both sides of the border passed through the tunnel. The town councils of Sarnia and Port Huron presented Sir Henry with addresses, and at a later hour a grand banquet was given in Sarnia, where congratulatory speeches and general good fellowship cemented the new bond of commercial union between the two nations.

In the construction of the St. Clair River tunnel, two deep cuttings were made, one on each side of the river; that on the American side had a depth of 53 feet, and that on the Canadian side 58 feet deep. Upon the floor of each cutting, against the head thereof, one of the great shields was placed, and the work of tunnelling began. In conjunction with the shield Mr. Hobson brought to his aid the admirable system of using compressed air in tunnel work, the invention of Mr. Dewitt C. Haskin, of New York, who first used it in the Hudson River tunnel. This air pressure system is a necessity in helping to uphold the soft earth of the tunnel heading. Each shield was circular, 21 feet 7 inches in diameter, 16 feet long, and is built of plate steel, one inch thick, divided into twelve compartments by means of two horizontal and three vertical stays. The front or heading end of each shield was made with sharp cutting edges. Arranged around against the walls of the rear end of the shield were twenty-four hydraulic rams, each eight inches in diameter and a stroke of 24 inches. By their means the shield was forced forward enough to admit of the building up of a section of tunnel rings within the shield. The power supplied by a



1. Sectional elevation and plan of tunnel; A, pump shaft; B, brick air shafts; C, cuttings; DD, bulkheads. 2. Cross section of tunnel and river. 3. Map showing location. 4. Plan of Port Huron and Sarnia, showing position of tunnel. 5. Section and plan of iron shoe of shaft. 6. Segment of cast iron of which the tunnel is composed.

CONSTRUCTION OF THE ST. CLAIR TUNNEL.

The tunnel, exclusive of the cuttings at either end, is 6050 feet long, as follows:—From the cutting to the river edge on the American side, 1800 feet; on the Canadian side, 1950 feet, and the distance across, under the river, 2300 feet. The estimated cost was $3,000,000, but the real cost is said to have been less than that amount. The lower half of the tunnel is lined with massive brick work. It is ventilated by means of two 20-inch tubes along the roof, extending from the centre to the entrances, and thence underground to a side building where they connect with large Root blowers. The *Scientific American* thus describes the work and method of construction of the tunnel:

Worthington pump was capable of producing a pressure of 5,000 pounds per square inch, or 3,000 tons on the 24 rams. The greatest pressure used was 1,700 pounds per square inch, which is 40 tons per ram and 1,060 tons on the shield. Each ram had a separate stop cock, so that its pressure could not be let on or shut off at will. Thus all of the rams could be operated simultaneously or a portion of them, or singly as required. Thus by letting on or shutting off pressure the shield could be guided and directed in any direction desired, up, down, or laterally, and made to traverse the exact grade required. The shields weighed eighty tons each, and were built from the designs of Mr. Hobson, by the Tool Manufac-