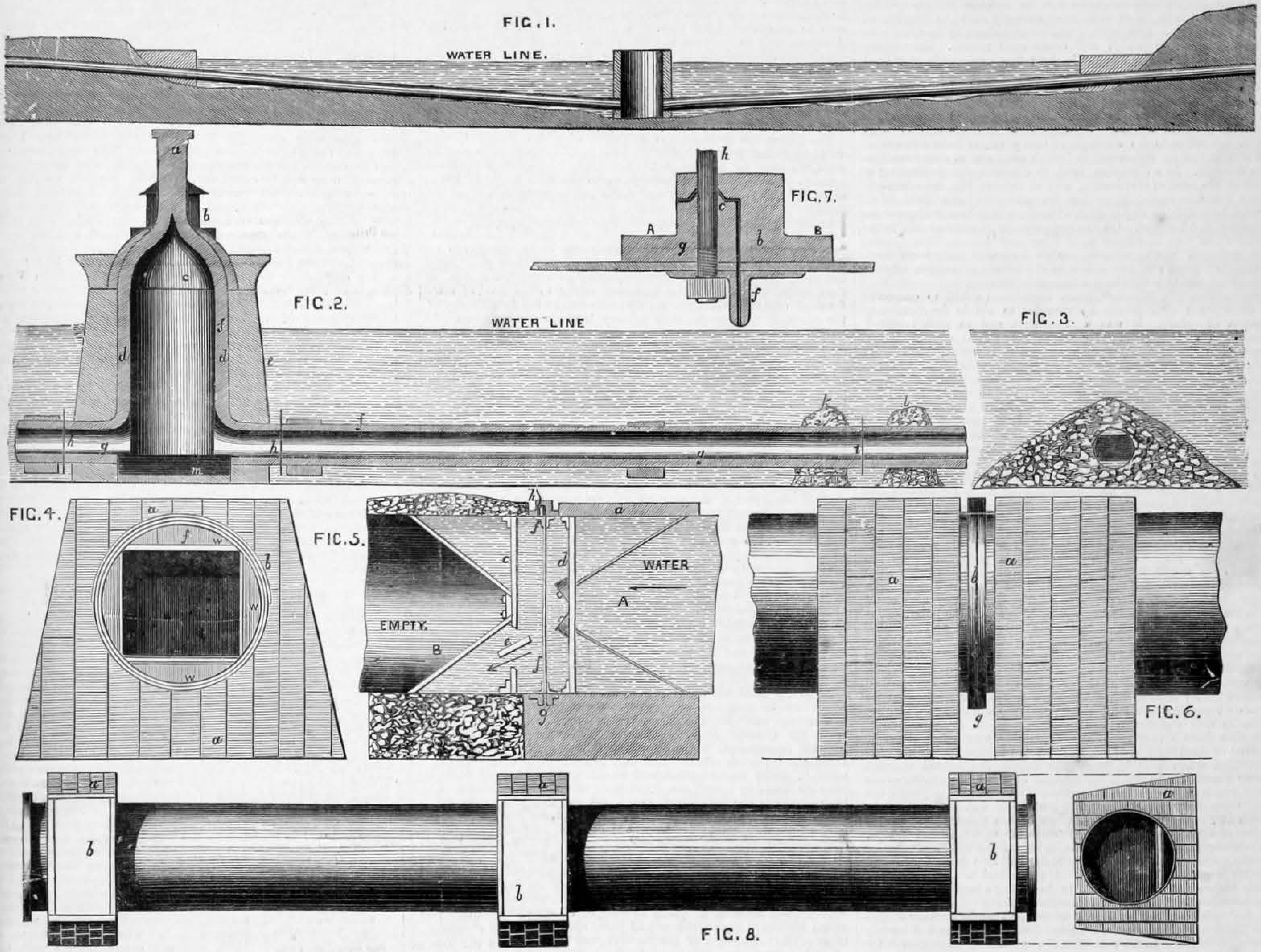
THE UNDER-CHANNEL RAILWAY.



Mr. James Chalmers, of Montreal, has patented the means whereby he proposes to open a railway communication under the Channel. In his specification he says that his invention has for its object improvements in constructing roadways under water, and consists in submerging tubes of suitable dimensions and construction, in place of having recourse to tunnelling, as heretofore. The shape and form of the tubular roadway may be varied, but it is preferred that such tubular roadway for deep water should be of a circular section, having a rectangular inner way formed therein, as thereby the pressure of the water at great depths may be divided between the tubes by allowing the leakage of the outer or circular tube to collect between it and the inner one, until it obtains such pressure as the inner or square tube may safely carry, then drawing it off through valves into the inner tube, thus relieving by reaction the pressure on the outer or circular tube. The lengths or sections of a tubular way have each bulkheads or partitions, one near each end, which are of a strength to resist the pressure of the water when the length or section is submerged, and when it has been emptied of water. Each end of a length or section of the tubular way is also formed with inner flanges, as well as with an outer flange. The construction of a tubular roadway may be commenced from either shore or bank, but it is believed that generally it will be preferable to commence at a spot intermediate of the two shores or banks of the river, sea, or other water, through and submerged in which a tubular roadway is to be constructed. In order to commence the works at a point intermediate of two shores or banks, a tower is first submerged of such dimensions as to descend to the bottom of the water, and to ascend to some height above its upper surface, provision being made for connecting the ends of the tubular ways on opposite sides of the tower in like manner to that in which the ends of the lengths or sections of the tubular way are connected end to end, when they are submerged. In the tower suitable steam engines, pumps, and machinery are to be constructed, in order to pump away the water in the tower, and to keep it free from water. The lengths or sections of the tubular roadway are in succession floated out to the positions they are to occupy, and are then submerged and coupled up, and their inner flanges rivetted or connected by screw bolts and nuts, and, as each length or section of the tubular roadway is in succession coupled up, the water used therein to aid in submerging it is allowed to flow from it into the sections previously submerged, and thence to the tower where the water is raised and pumped away. And in order to have a clear way through the sections or lengths of tubular roadway between the tower and the length next to the one last submerged, the bulkheads or partitions are removed as the work proceeds, the outermost bulkhead or partition remaining till another section or length has been submerged, and has been affixed to the end of the one previously submerged, and the work is so carried on, that the pressure of the outer water acts on the last submerged section or length of the tubular way, to force it against the end of the one previously submerged and fixed. In order to retain the sections or lengths of the tubular way from floating when they are empty, each section is formed with hollow chambers, which are open above but enclosed on all sides, and at the bottom these chambers surround the tubular way, and by having deposited therein a quantity of stones retain them from rising when once submerged and got correctly into position, the chambers being loaded before running off the water contained in the section or length, and before releasing the section or length from the tackle used in submerging it. A section or length of the tubular way having been floated into the position where it is to be submerged, it is made fast to the tackle employed, and a quantity of water is allowed to enter, but not sufficient to cause it to sink; the section or length retaining a quantity of its buoyancy, is gradually drawn down under the water by means of tackle, and brought with its end against the end of the section or length previously submerged and fixed. The tackle used for submerging the sections consists of chains, which are passed through blocks or suitable apparatus anchored or fixed below the water in such manner as to bear the strain of submerging the sections or lengths of the roadway, and such tackle and apparatus is so arranged and worked that the section or length which for the time is being lowered shall be submerged to the proper depth, and the depth and position of it indicated as the work proceeds. In order to ascertain when the end of a length or section of the tubular roadway has been brought into position, or nearly so, there are openings in the bulkheads or partitions fitted with strong glass, through which, by the aid of strong light from within the fixed part of the tubular way, the presence of the end of the section or length which is being brought into position may be seen, and so soon as the ends have come together correctly, the end pressure will be greatly increased by withdrawing some of the water which is in the space between the two bulkheads or partitions of the two sections or lengths of the tubular way which have by the working of the tackle been brought together.

Fig. 1 shows a section or profile of a channel or river, and of the outline of a tubular roadway; Fig. 2 shows a section of ventilator; such ventilator will be best constructed of iron and stone, *e* and *d* being two circular vertical shells or tubes with stonework built between them. The bottom *m* may (in order to give strength) be a double cellular bottom, the cells may be filled with concrete when built, launched, and sunk in its place. The water between the shells *e* and *d* may be pumped out, and the stonework built. *a* is the ventilator or chimney that draws the smoke and foul air from the flues *f*, *f*, which are used when the width of the water is great; *b* is space for a light-house where one is required, as in a navigable channel; *g*, *g*, level of the roadway, the space between the bottom *m* and the roadway is for drainage; *h*, *h*, joinings of tubes to ventilator, they will be joined in the same manner as they are joined to each other, as hereafter described; *h*, *i*, one length or section of tubular roadway such as may be submerged at a time. When the surface or bottom is ascertained to be uneven, the chamber *k* can either be shortened by reducing the height, or lengthened by adding blocks of timber, as shown under chamber *k*, and the other chambers may be partly open in the bottom, allowing material to pass through and form a bottom on the bed of the stream or channel, as is shown at the chamber *l*; or when it is desirable to make something more permanent than a simple iron tube, by lining it with brick or otherwise, the whole tube may be covered by an embankment as in section Fig. 3. When required at great depths the tubes may be double, a rectangular within a cylindrical tube, and water may be allowed to collect in the spaces *w*, *w*, *w*, (Fig. 4) between them until it attains such a pressure as the inner or square tube may safely carry, then drawn off through valves into the inner tube. The space *f* is reserved for ventilation where required. *a*, *a*, *a*, *a*, Figs. 4, 5, 6, and 8, are the boxes or chambers for loading down the tubes, and *b*, *b*, *b*, Fig. 8, are the open parts to renew the loading. These boxes will be best made of iron plates, rivetted together and attached to the tubes by angle iron. Fig. 5 shows method of joining the tubes together under water. Fig. 6 shows an elevation of the ends of two tubes joined together. Fig. 7 shows a method of guiding the ends together. The bolt *h* is fastened inside of tube A when secured in its place. This bolt has attached to its end a wire cable (see Fig. 5) which, while a tube B is on the surface of the water, is passed through a hole in flange *b*, and as the tube B descends to its place the bolt *h* guides the flange *b* till it rests on the cone *c*; a circular cone surrounds the bolt hole in the flange *g*, and the flange *b* is a semicircular projecting flange, which overlaps the flange *g*, and guides the end of the tube B to the end of the one previously fixed in its place; when the ends are firmly brought together they are joined, as in Fig. 5. Tube A is shown to be fixed in its place, and freed from water inside of the partition *c*. Through the dead lights in the said partition *c*, aided by strong reflecting lamps, it will be seen when the flanges of the ends of the tubes A and B come together; then the valve *e* is opened, allowing the water between the partitions *c* and *d* to escape through tube A, when the outer pressure on tube B will force the flanges *b* and *g* together, and as they have an elastic or compressible substance between them a water-tight joint will thus be made, and men will be able to pass into the space between the partitions *c* and *d*, and by bolting the flanges *f*, *f*, together they will make a permanent joint. The tube B is then to be loaded down, the bolt *h* will be withdrawn, the partition *d* will be removed. The operations will be repeated at the other end of the tube B, when another length of tube is lowered. The tube B is furnished with a partition *c* and valve *e*, the same as in tube A, and the work thus continued until the tubes reach the shore. When the depth is not great a plain cylindrical tubular passage may be formed strengthened by angle or T-iron, with floor and ceiling, as in section Fig 3, or with floor only, as in section Fig. 8.

Railways in Italy.—A private letter from Turin gives a favourable account of the progress of the Bologna and Ancona Railroad. "M. Salamanca," it says, "had engaged to open for traffic on the 1st of January, 1862, this line, which is not less than 206 kilometers. Half of it is working since the 5th inst., and the whole will be open during the first fortnight of November. In two years M. Salamanca will have connected Rome with Naples and Turin. What, I ask you, can diplomacy do against such an union? You are aware that in Portugal also he is the constructor of the lines which will unite Lisbon with Oporto, and Portugal with the Spanish lines. Here again is another union which must be henceforth taken into account. The line from Naples to Rome will be finished next year, and in the meantime the two capitals will be drawn closer to each other, so that in a couple of months there will be a very limited number of kilometers remaining to be finished."

Artesian Wells.—A communication has been received on this subject by the Academy of Sciences from M. Gaudin, in which he replies to the question often asked, whether the supply of the Artesian wells, bored in the neighbourhood of Paris, can ever be exhausted? The stratum of green sandstone interposed between the strata of chalk and Jurassic limestone is of the average thickness of 164ft.; consequently, taking the depth of $1,892\frac{1}{4}$ft. of the Artesian well at Passy as a criterion, there remains a depth of 82ft. of sand. A cubic metre of sand, closely rammed, weighs 1,600 kilogrammes, while compact quartz weighs 2,500 kilogrammes; hence the stratum of sand, even supposing it to be closely packed, has interstices amounting to one-third of its bulk in the aggregate, so that every cubic metre ($85\frac{1}{2}$ cubic feet) of sand under water contains 333 litres ($73\frac{1}{4}$ gallons) of water. Now, the layer of sand existing under the chalk may be represented by a disc of 100 miles radius, and its thickness to 26ft. The cubic contents of this disc are, therefore, 141,512,500,000,000 gallons, which, divided by 22,060,000,000, then by 365, gives the quotient 175, being the number of years requisite to exhaust the supply of water at the rate of 10,000,000 cubic metres (22,060,000,000 gallons) per day! This would be correct, supposing the quantity of water to remain stationary, and never to receive any increment by the infiltration of rainwater and that of rivers. This our author calculates at half a metre per annum, and thence arrives at the conclusion that the annual increase of the water is double the quantity expended, so that the Artesian wells in or about Paris are, and must ever be, inexhaustible.