THE APPLICATION OF STEAM TO CANALS.---NO. I.

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The immense capital invested in canal property, and the extended lines of inland navigation throughout the various districts of Great Britain, Northern Europe, and the United States of America, cause regret that, while so much has been done in years past to develop the trading interests of these countries, such extensive internal communications have been suffered to remain dormant, burdened by the same defective system of navigation which, once ample for the transportation of goods, when the pack horse and the country wagons were their only competitors, now is in most miserable contrast with the perfected system and dispatch that characterizes the management of the railways of the present day. The defects and delays in the transportation of goods *viâ* canal, not lessened by the private interests and conveniences of drivers, boatmen, and others engaged in their traffic, where heavy boats are dragged from one destination to another at the slowest possible speed, by the wretched beasts that lean for support against the towing lines, point to the necessity of a radical change, to redeem them from the position to which they have sunk, in the competition of the day.

Commencing with the early history of canals, we propose to present some of the more prominent experiments which have been designed to improve the construction of vessels adapted to inland navigation, and the application to them of mechanical means of propulsion.

Save that the large drains cut by the early churchmen in the Cambridge fens seem to have been employed for purposes of occasional inland navigation as early as the fifteenth century, the great commercial republic of Holland may safely claim centuries of European priority in the construction of a system of artificial water-roads, which the industry of its people had turned to a good account of prosperity and power. France, Sweden, add even semi-barbarous Russia, had also taken the lead in this respect long before England had entered upon her career of canal construction; though in Egypt, long before the invasion of Great Britain by the Gauls, and in China, at a still earlier date, we know of their introduction, yet their origin is undoubtedly merged in the system of irrigation which, for unknown ages, has been pursued in those countries.

Certain authorities have claimed that during the invasion of England by the Romans, the works executed by them in the Fen districts were also used for navigable purposes, but of this we have no tangible proofs. In 1623, however, we find from Parliamentary records that Sir Hugh Myddleton was engaged in considering a bill "For the making of the River Thames navigable to Oxford;" while, twenty-three years later, one Francis Mathew addresses, to Cromwell and his Parliament a paper upon the immense advantages of opening up a water communication between London and Bristol, which purposed making the rivers Isis and Avon navigable to their sources, with a short canal to connect their heads across the intervening country; but, for Mathew's time, a scheme for the construction of three miles of canal, even by the State, was far too daring, and a century elapses before a canal is made in England.

Andrew Yarrington, gentleman, next publishes, in 1677, a curious book, entitled "England's Improvements by Sea and Land, to outdo the Dutch without fighting, to pay debts without moneys, to set at work all the poor of England with the growth of our own land," in which he strongly contrasts the prosperous energy of the Dutch, especially regarding their inland water communication, with the passive indifference of Englishmen to the immense advantages in their numerous streams and rivers, lying dormant at their very doors, wanting only improvement in their existing beds, with proper connection, to develop the trade and prosperity of the country.

To the lack of capital at this time can be traced the secret of the little progress of the internal communication of the country, and, though Parliament liberally granted permission for river improvements, yet, from the want of money, few were attempted, or, if commenced, failed from the same cause.

About the beginning of the eighteenth century, the opening of the navigation of the rivers Aire and Calder gave a great impetus to the trade of that portion of Yorkshire, and stimulated the demand for improvements in inland navigation; and we find its first fruits in an act of 1720, to make navigable the Mersey and Irwell, from Liverpool to Manchester; and, at about the same time, acts for the improvement of the Weaver, Douglass, and the Sankey navigations were granted, and, what was more to the purpose, the works carried out. Again, in 1817, as a reference to the pamphlets of the British Museum will show, Dr. Thomas Congreve published some views, headed "A Scheme and Proposal for making a Navigable Communication between the rivers Trent and Severn, in the County of Stafford," which paper project slumbered for forty years, till, in 1755, a survey was made for this very line of canal, under the auspices of the "Liverpool Corporation of Merchants," which line proceeded by Chester to Stafford, Derby, and Nottingham; and from Brindley's "Note-book" we find that he executed a fresh survey over the same ground in the years 1759–60, but at the expense of Earl Gower and Lord Anson.

Thus, it is not till the middle of the last century that English enterprise was fairly awakened to the necessity of a system of artificial canals; and directly traceable to the execution and extension of these earlier river improvements, can we date the present system of internal communication, which has conduced so largely to the industrial prosperity of the English nation; and to the consequent increase of British manufactures, and their distribution, do all countries owe many of their indispensable comforts of life.

Apart from the deductions that would naturally follow from the river improvements, it is well known that, in 1755, the deepening and widening of the Sankey-brook, tributary to the Mersey, with the application of a floodgate for retaining tide water, gave the hint which culminated in the construction of the well known Bridgewater canal, under James Brindley; but the rapidity of extension was afterwards such that, between the years 1760 and 1803, no less than 2,295 miles of canal were opened. From the exceedingly interesting history of this society, written by Mr. Davenport, we learn that the gold medal of the Society of Arts was awarded, in 1800, to the Duke of Bridgewater, as the father of inland navigation, and for his general exertions in promoting the interests of inland water carriage; since which date there seems to be no note of special award to the workers in this particular field of the economy of the nations. Indeed, since the adoption of canals, except in the substitution of horses for men at the towing lines, and some improvements effected in the manner of passing boats from one level to another, they may be truly said to have remained stationary in the general march of improvement, and, unlike all other arts, have partaken of none of the benefits arising from the increase of mechanical science.

It is with the view of calling attention to the fact, that, by the exercise of a tithe of the mechanical ingenuity which has been expended on railways, canals might again assume a position and importance which, if not in general economy superior to railways, yet may, in relative utility, compete in the transit of minerals, and other merchandise, that this paper is now before you; and the immense capital embarked in canals certainly renders it a subject of national as well as pecuniary importance.

A further enumeration of the progress of canal construction in this country is unnecessary, yet a glance at the commencement of inland works in America will be interesting; and in connection we find, as early as 1724, Cadwallader Colden, then Surveyor General of the colony of New York, suggesting a system of works somewhat similar to those now existing. Sir Henry Moore, the Governor of the colony, in 1768, also recommended the improvement of the inland navigation. These recommendations slumbered through the Revolutionary war which followed, to be again projected with the independence of the country. As in England, the improvement of the existing navigations was first in course, and, as early as 1791, acts for surveys and estimates relating to the removal of obstructions to the navigation of the Hudson and Mohawk rivers were passed. In the following year, the Western and the Northern Inland Companies were incorporated, and, by 1802, the former company had succeeded in spending an immense sum of money, with but very small proportional results. The route now occupied by the Great Erie Canal was adopted in 1812, repealed in 1814, to be again revived two years later. Ground was broken near Rome in July of the same year, while the first boat passed from Lake Erie to the Hudson in October, 1825, thus consuming a little over eight years in constructing the distance of 364 miles, with a total of 71 locks. The Champlain Canal was commenced in 1816, and completed in 1823, since which date the many lateral branches of the Erie have been added to the system, and the application of inland navigation extended to many of the other States.

It is a fact of interest, that the original dimensions of these canals were established by the commissioners, in 1817, at 40 feet in width by 4 feet deep, with locks 90 feet by 15; but, as early as 1834, the wants of a growing commerce demanded an increase of capacity, and in 1835, an act of enlargement of the Erie Canal was passed, since which time the depth has been increased to 7 feet, its width to 70, and the locks to 18 by 110 feet. Before the commencement of the Erie, the cost of transporting a tun of merchandize from Buffalo to Albany equaled £20, and consumed twenty days; the canal at once reduced the cost to £4, or one fifth, and the time to eight days. But mark, that the mere enlargement of the canal again reduced the average cost of movement, including all tolls, to ten shillings per tun, or one eighth of the expense previous to the improvements.

It may be interesting to review some of the more or less ingenious attempts to overcome the disadvantages of towing by horses, and hastily glance at the various methods of propulsion by mechanical means which have been especially designed to supersede animal labor in propeling boats on inland navigable waters, in Europe and America, up to the present time. In this enumeration, we shall necessarily find, among the first experiments, some which have been broadly designed for purposes of general navigation, and touch upon the early history of the steam engine; but, so far as possible, preference will be given to those where application to canal or river navigation has been the paramount idea of their inventors.

CARAVANS.

Every caravan is under the command of a chief. When it is practicable, they encamp near wells or rivulets, and observe a regular discipline. Camels are used as a means of conveyance, and there are generally more camels in a caravan than men.

The commercial intercourse of Eastern and African nations has been principally carried on, from the remotest period, by means of caravans. The formation of caravans is the only way in which it has ever been possible to carry on any considerable internal commerce in Asia or Africa. The governments that have grown up in these continents have seldom been able, and seldom have they attempted, to render traveling practicable or safe for individuals. The wandering tribes of Arabs have always infested the immense deserts by which they are intersected, and those only who are sufficiently powerful to protect themselves, or sufficiently rich to purchase an exemption from the predatory attacks of these freebooters, can expect to pass through territories subject to their incursions without being exposed to the risk of robbery and murder.

In the pilgrimage to Mecca enjoined on the followers of Mohammed, the prophet grants them the privilege of trading: "It shall be no crime in you if ye seek an increase from your Lord by trading during the pilgrimage." The camels of each caravan are loaded with those commodities of every country which are of easiest carriage and readiest sale, and during the latter part of the month of June and the early part of July, the Holy City is crowded with opulent merchants and zealous devotees. A fair or market is held in Mecca on the twelve days that the pilgrims are allowed to remain in the city.

Few pilgrims, says Burckhardt, except the mendicants, arrive without productions of their respective countries for sale. Pilgrims from Morocco and the north coast of Africa bring their red bonnets and woolen cloaks; the European Turks, shoes and slippers, hardware, embroidered stuffs, sweetmeats, amber, trinkets of European manufacture, knit silk purses, etc.; the Turks of Anatolia bring carpets, silks, and Angora shawls; the Persians, cashmere shawls and large silk handkerchiefs; the Affghans, tooth brushes, made of the spongy boughs of a tree growing in Bokhara, beads of a yellow soapstone, and plain coarse shawls manufactured in their own country; the Indians, the numerous productions of their rich and extensive regions; the people of Yemen, ornaments for Persian pipes, sandals, and various other works in leather; and the Africans bring various articles adapted to the slave trade. The pilgrims are, however, often disappointed in their expectations of gain: want of money makes them hastily sell their little adventures at the public auctions, often at very low prices.

The two principal caravans which yearly rendezvous at Mecca are those of Damascus and Cairo. The first is composed of pilgrims from Europe and Western Asia; the second, Mohammedans from all parts of Africa. The Syrian caravan is said by Burckhardt to be very well regulated. It is always accompanied by the Pasha of Damascus, or one of his principal officers, who gives the signal for encamping and starting by firing a musket. On the route, a troop of horsemen ride in the front, and another in the rear, to bring up the stragglers.

The different parties of pilgrims, distinguished by their provinces or towns, keep close together. At night torches are lighted, and the daily distance is usually performed between 3 o'clock in the afternoon and an hour or two after sunrise on the following day.

The Bedouins or Arabs, who carry provisions for the troops, travel by day only, and in advance of the caravans, the encampment of which they pass in the morning, and are overtaken in turn and passed by the caravan on the following night at their own resting place. At every watering place on the route is a small castle and a large tank, at which the camels water. The castles are garrisoned by a few persons, who remain the whole year to guard the provisions deposited there. It is at these watering places, which belong to the Bedouins, that the sheikhs of the tribe meet the caravan, and receive the accustomed tribute for allowing it to pass.

The caravan which sets out from Cairo for Mecca is not generally so large as that of Damascus, and its route along the shores of the Red Sea is more dangerous and fatiguing. But many of the Africans and Egyptian merchants sail from Suez, Cosseir, and other ports on the western shore of the Red Sea, for Djidda, whence the journey to Mecca is short and easy. The Persian caravan for Mecca sets out from Bagdad; at many of the Persians are now in the habit of embarking but Bussorah, and coming to Djidda by sea.

Caravans from Bagdad and Bussorah proceed to Aleppo, Damascus, and Diarbekir, laden with all sorts of Indian, Arabian, and Persian commodities; and large quantities of European goods, principally of English cottons imported at Bussorah, are now distributed throughout all the Eastern parts of the Turkish Empire by the same means. The intercourse carried on in this way is every day becoming of more importance.

The commerce carried on by caravans in the interior of Africa is widely extended and of considerable value. Besides the great caravan which proceeds from Nubia to Cairo, there are caravans which have no object but commerce, which set out from Fez, Algiers, Tunis, Tripoli, and other States on the seacoast, and penetrate far into the interior. Some of them take as many as 50 days to reach the place of their destination, traveling at the rate of from 18 to 22 miles per day.

The trade of these caravans is a barter of various kinds of goods for slaves. Three distinct caravans are employed in bringing slaves and commodities from Central Africa to Cairo. They do not arrive at stated periods, depending upon the success they have had in procuring slaves, ivory, gold dust, drugs, and such other articles as are fitted for the Egyptian markets. The largest of these caravans, the Darfur caravan, consists of 2,000 camels, and its departure is looked upon as a most important event, and for a while engages the attention of the whole country.

Caravans are distinguished into heavy and light. Camels loaded with from 500 to 600 pounds form a heavy caravan; light caravans being the term applied to designate those formed of camels under a moderate load or half a load.

No particular formalities are required in the formation of caravan. Those that start at fixed periods are mostly under the control of government, by whom the leaders are appointed. But any dealer is at liberty to form a company and make one. The individual in whose name it is raised is considered as the leader, unless he appoint some one else in his place. When a number of merchants associate together in the design, they elect a chief, and appoint officers to decide whatever controversies may arise during the journey.

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