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Amongst all the factors that have contributed towards the remarkable development of the British Empire, steam must have a prominent position.

In the third quarter of the 18th century the country stood in need of a new motive power for manufacturing purposes. The expansive power of steam had long been noticed, and a few pioneers had been speculating on the possibility of utilising it to drive machinery. Newcomen invented a tolerably efficient steam engine, but it was not, however, until 1769 that James Watt obtained his first patent for "lessening the consumption of steam and consequently of fuel." Before the end of the century steam was established as the grand motive power.

Of all the applications of steam, perhaps its adaptation for railways has been the most potent factor in the development of the British Empire. Railways have been constructed in Great Britain in order to facilitate intercourse along old channels, to bring into closer connection the great manufacturing centres with each other and with the great markets, but they have often been built to create a traffic and sometimes a new industry and even a population. The resources of the land have then been developed, more has been produced than was necessary for local consumption; mineral and other natural wealth, hitherto profitless, has been made ready for export, the traffic has grown and the existence of the railways has been ultimately justified.

It was early realised that the new method of locomotion was certain to play an important part in opening up British North America. From a humble beginning in the Champlain and St. Lawrence Railway, has been woven the huge railway network of Canada, which now gridirons the country in all directions, and aggregates some 25,000 miles. The Grand Trunk Railway provided a railroad between the Atlantic seaboard and the Great Lakes. Subsidiary railways were absorbed linking Canada with such busy manufacturing centres in the United States as Chicago and Buffalo. By the Canadian Pacific Railway intercourse was rendered easy between all parts of the vast Dominion. but it also provides a new imperial route to Australia and the East. The extension of railways in Canada has increased the volume of immigration to the immense areas of unoccupied, fertile lands, the agricultural, manufacturing, and mining industries are becoming more important every year, trade is expanding and the wealth of the people is rapidly becoming greater.

Although large expanses of Australia still rank as terra incognita, the iron horse is rapidly tearing the veil from the unknown, it is fulfilling the dual role of exploring and colonising force. In South Australia the tendency has been to anticipate the settler, and thus, by the provision of means of transport to attract the farmer into the district. The rail-roads of Western Australia have been laid out to cope with the extensive mining movements. The discovery of gold at Coolgardie drew the railway inland for nearly 600 miles. The Transcontinental Railway will undoubtedly prove of distinct military and commercial

value.

In New Zealand an unusually large number of bridges had to be built to span the chasms and gorges. Christchurch on the east coast of South Island is connected with Greymouth on the west and the North Island Trunk Railway runs from Wellington to Auckland. These are the two main steps essential for New Zealand's welfare and progress.

Railways were begun in South Africa in 1859. Forty years later 2,500 miles had been laid down. The advantages of a railway in a land of slow communication by ox-waggon and where the vinderpest restricts even this mode of progression, are many. In Nyasaland the British Central Africa Company has exploited the incalculable wealth of that country. The railway has also helped to break up the slave trade around Lake Nyasa.

The dream of Cecil Rhodes, one of our greatest empire-builders, was to construct a railway from the Cape to Cairo. The line from Cape Town was continued to Mafeking, then, as the colonisation of Mashonaland had progressed so favourably and as the Matabele under Lobengula were giving signs of trouble, construction was pushed on to Bulawayo. It has now reached Elizabethville over 2000 miles from its starting point. In North Africa the railway wrested a vast tract from barbarity and religious fanaticism in the form of Mahdism. From Senhar a line runs to El Obeid, the centre of the gum trade, one of the most prosperous and expanding industries of the Upper Sudan. The Government has also built a line from Atbara to Suakin and Port Sudan on the Red Sea.

In India the lack of transport kept

The village isolated and independent to a much later period than in Western Europe. Railways have now made it unnecessary for the ~~rural~~ population to depend for the necessaries of life upon their own locality, and they have lifted from the village the never-absent apprehension of death by starvation. On the other hand, assured of access to the large European markets, the cultivator no longer dreads that a bumper harvest will so glut his petty local mart that his produce cannot be sold at all. Half the population of India belongs to this class and they unquestionably gain by getting a good price for their produce. The wheat, rice, seeds and butter of the rural districts now go to the seaports and large towns and money flows into the village in return.

The "Toy" railways modelled on that at Festiniog have been constructed in many parts, notably in what was German South West Africa and in Alaska, the former to exploit the copper and the latter to enable the gold diggers to reach Klondyke.

And so details might be given from all the outlying parts of the Empire showing the beneficent influence steam has conferred in the form of railways.

To expedite the construction of railways, wonderful implements have been devised. The steam shovel will remove 2½ cubic yards of miscellaneous rubble with every swing of its ponderous arm. The grader ploughs up and removes the soil by an endless chain of buckets. The drag shovel, a huge scoop attached to the end of a chain, is pulled along the ground from a stationary point by steam power, becomes loaded in its

progress, and thus fashions the cutting. The steam monitor washes tons of gravel down the mountain-side under the disintegrating force of a powerful jet of water.

Steamships play a great role in bringing all parts of the Empire together. They are both speedier and safer than sailing ships. Upon the British mercantile marine the United Kingdom depends for an immense proportion of its food supplies, its enormous quantity of raw materials, and for means of exporting its manufactured goods.

Ocean navigation underwent a revolution when the marine steam-engine was invented, and side by side with improvements in its construction the size of vessels so increased that today liners of 50,000 tons register, and carrying 3000 passengers ply regularly across the Atlantic, the northern part of which is the busiest ocean route in the world. The trade between the United States and Britain is carried on by huge vessels of the Cunard, White Star and Canadian Pacific lines. The Union Castle line to South Africa, The Royal Mail Steam Packet to South American ports and the New Zealand Shipping Company are important lines trading across the South Atlantic. Next in importance is the Mediterranean Route, along which passes most of the traffic with India, China, Japan and Australia, the Peninsular and Oriental and the Orient steamship lines, from Tilbury, being the most important British lines engaged.

Special types of boats have been developed adapted to the needs of the trades in which the vessels are engaged, such as tankers, meat-carrying vessels fitted with refrigerating apparatus, and tugs for towing ships, rafts, fishing-nets, and oyster dredges. Steam dredging machines

are requisitioned for deepening harbours and the mouths of rivers, and steam navvies and excavators for the making of docks, railway-cuttings and canals.

The growth of population and increase of trade in recent years have been more marked in Australasia than in the Canadian Dominion because steam brought it nearer. Nyasaland progressed remarkably between 1891 and 1896 because of the additional steamers placed on Lake Nyasa. The Sudan Development and Exploration Company possesses a steamship route between Khartoum and Gondokoro, giving Uganda an outlet to the Mediterranean. In Canada the birch canoe has been ousted by the steamboat on such rivers as the Mackenzie.

Machinery, has in most cases supplemented or even supplanted muscular effort altogether until the steam power of Great Britain is calculated to be equal to the manual labour of 400 million men.

Steam effects its greatest economies when many machines can be worked by one engine, in a limited space, and where organisation and supervision are easy, so that those which employ several hundred hands in one building are the most profitable factories. Thus instead of a small number of people engaged in weaving, spinning and combing, scattered through a large district, we have an immense population concentrated in one place. Towns like Birmingham are a product of steam power. But the great towns which were everywhere being built, could not have existed or at any rate been fed if the old means of locomotion had alone been available.

In the construction of the vast modern buildings steam traction engines are used for hauling heavy castings and boilers from the workshops, while steam hoists and cranes swing enormous weights into their proper places. In making macadamised roads, steam rollers crush down, and consolidate the metal so as to form a smooth road. And now steam is utilised for the production of electricity in the great generating stations.

In agriculture steam is of great service. By its use large areas of land may be drained and cultivated much more expeditiously than would be possible with the ordinary number of horses, and speed is an important consideration especially in precarious seasons. Steam operates cultivators, disc-harrows, drills, multiple hoes, mowers, hay-rakes, elevators, reapers, binders, and threshing machines, cream-separators, food grinders, and manure spreaders.

Every new application of steam power has called for fresh supplies of fuel. Consequently coal mining long ago passed from the position of a minor industry to one of greatest importance. The application of steam to the newly invented jenny, mule and power-loom affected all the textile industries, resulting in an immensely larger market for fabrics of all kinds.

India has more than quadrupled her capacity to spin and weave cotton by steam-power in less than one generation. In jute her capacity in 23 years has increased more than five-fold and in spinning and weaving of wool there is a considerable increase, though the demand for wool is comparatively small. In the manufacture of paper it has increased four-fold

and the development in the in the mining industry has been still more remarkable.

Innumerable contrivances might be mentioned to show how steam enters into the working of every department of life at home and abroad. In 1839 Nasmyth constructed the steam hammer, which went a long way towards revolutionising the manufacture of iron. A brake can be applied by the action of steam admitted to a steam cylinder. A steam kitchen is an apparatus for cooking by steam. A steam tank is one in which materials are treated either by direct contact or with steam heat by means of pipes. Such tanks are used for steaming wood, paper and lard. A steam worm is used in tanks for heating liquids in tanneries, laundries and dye works. Books of travel, newspapers, propaganda literature advertising the colonies are all produced by steam driven machines. And lastly a steam-whistle gives signals and announces hours of work.

In every part of the British Empire steam has proved itself the most tractable and powerful of agents. It has extended the dominion of man over inanimate nature, given man almost unbounded supremacy over the materials which enter into his daily use, and increased his power, his resources and his enjoyment.