Safety:

There should be a few paragraphs at least on the interesting development of safety devices. Westinghouse's contribution is first - first the air brake, then his ~~bridge~~ switch and signal contribution. His first patent came in February 1881, twelve years after his first patent for an air brake. He called it part of thepneumatic or hydraulic apparatus, preferably compressed air. This was followed by a ~~block~~ signalling apparatus in which fluid pressure was tried. It was followed by twelve patents between 1881 and 1891. That is in these ten years he took out these twelve patents, for ~~bridge~~ switch and signal apparatus. First, fluid pressure mechanism. Later, fluid pressure combined with electricity.

In 1883 he took out a patent for electric circuit for a railway signal. His last patent was, according to Prout the final form of the electrop neumatic inter-locking machine

"The final form of the electropneumatic interlocking machine which Westinghouse had been working at for ten years, in combination with elements that he had developed and patented from time to time. It is his most important patent in this art, being the simplification and synthesis of all that had gone before. It is unusually elegant in detail and is an interesting example of evolution."

(Prout, Henry G. C.E., A.M., LL.D. A Life of George Westinghouse 1926. Page 361, 362.)

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The manufacture of the plant he had taken to Pittsburgh, Pa., and by this time, 1888, he had a business amounting to $ a year. His first attention to the use of electricity, to the practical attempt to use electricity, was when he took out a patent in 1881 when Brush lighted Wabash - Edison furnished homes with incandescent lights. Hundreds of patents came out, but Westinghouse paid little attention to them until All he was doing was to use electric circuits for contol in his railroad signals and brakes.

Then a phase of electric developments did arrest his attention. It was the direct current, the only one or as it was believed by so great a power as Edison, the only one possible to use. The difficulty with the direct current was that it could not be carried any great distance. It was clear that more and more powerful generators could and would be built. How to transport the power generated over long distances? Westinghouse saw power supplied to dwellings, factories, local lighting plants. How could it be carried farther, over the copper wires which were needed for its use?

The expense of making them large enough was too great. One of Westinghouse's interesting qualities was his curiosity about what other people were doing, and his interest in picking up useful inventors, and that prompted him to bring from

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Italy and Sqitzerland young scientists that had aroused his interest. One of these an Italian, Pantaleoni. Visiting Italy in 1885 he learned about ~~what~~ the first system of distribution of electricity by the alternating current on any important scale.

Westinghouse became interested in the report of what had been done and Westinghouse learning of this effort took the patents and turned lose the body of brilliant investigators which he had brought together to the working out of the alternating system of conveying electricity.

Within a few years there had been developed to a practical and satisfactory point the system which could at a reasonable cost convey electricity over a much longer distance than by the direct current. Soon ~~the~~ Westinghouse and the company were whelmed by over/ enthusiastic efforts over which he was captain. and had to solve an extraordinary group of all sorts of scientific and mechanical problems. From the first they met determined opposition of the leading trick inventors of the country. Most important among them, Thomas Edison.

It is probable that there was some effort to discourage the new development, the use of the alternating current from the financial interests ~~which~~ which by the end of the '80's were so heavily involved backing projects based on the use of the direct current.

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The public was appealed to on the ground that the alternating current was a menace to human beings. Terrible accidents had occured in attempting to use it and these were exploited to the full. The controversy was carried into the dignified North American Review where in 1890 1889 Mr. Edison and Mr. Westinghouse set forth their views on the safety and the economic value of the two currents.

Edison was severe. He declared that in his judgment there was neither scientific or commercial sense which justified the use of high alternating current, that if he had his way he would entirely prohibit their use. Now what was the trick in this ? The limitation on the amount of electricity transmitted lies in the cost of conductors. "This says, Prout, " is less if the volume of current is small and the voltage is high. This is seen in the early struggles of the direct-current central station to increase its area of distribution. The increase from 110 to 220 volts by the so-called three-wire system and the unsuccessful endeavor to devise other systems by which higher voltages could be used indicated the need of higher voltage and set the limit of the direct current. The transformer in permitting a small current, transmitted at high voltage, to be transformed into a large current at low voltage by means of stationary apparatus supplies the essential factor in electric transmission. This Westinghouse early appreciated. The whole

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story of electrical progress is the story of advancing voltages. Each increase has been followed by transmission to longer distances and the economic use of power on a larger scale.

"Westinghouse's conception of what had been done may be summed up in a few words to be found in a paper presented by him at a joint meeting of engineering societies in Longon in 1910:

"As an illustration of the wonders of the laws of nature, few inventions or discoveries with which we are familiar can excel the static transformer of the electrical energy of alternating currents of high voltage into the equivalent energy at a lower voltage. To have discovered how to make an inert mass of metal capable of transforming alternating currents of 100,000 volts into currents of any required lower voltage with a loss of only a trifle of the energy so transformed would have been to achieve enduring fame. The facts divide this honor among a few, the beneficiaries will be tens of millions."

(Henry G. Prout. A Life of George Westinghouse. Page 116)

Westinghouse was able to demonstrate in a most spectacular achievement in 1893, the trace of the alternate current, in the lighting of the Chicago Fair of that year.

By this time there were but two companies in the country equipped to undertake such an order. ~~The General Electric~~ The Edison General Electric Company, only just born by a combination of what is known as the Edison General Electric and the Thomson-Houston Company were / forced to do something that had never been done in the electric world before. The contract called for fourteen/alternating current motors of sixty five horse power each. The largest that the General Electric had built to that date was

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friction draft-gear

interested in electricity, not only a big force of brilliant young engineers but he had acquired a variety of patents. Among them was one for a friction draft-gear, 1888. (Prout, Page 83)

In 1878 two young Massachusetts inventors, Sawyer and Man, had succeeded in incorporating a company for carrying on a general system of incandescent electric lighting. This was two or three years before the Edison Company was organized in New York City.

Sawyer and Man were not able to see their enterprise through and sold their patents and efforts the next year. There was another turn-over and finally in Westinghouse bought the company with all its patents.

Among these was a carbon filament enclosed in an exhausted container which was made entirely of glass. This lamp as it stood had not been of any use, but for sometime the Westinghouse engineers had been trying to develop it and now with the stimulus of necessity behind them they did succeed in making a lamp which the Court ruled did not infringe the Edison patent. Edison's peculiarities that which gave it its name was called a stopper lamp. Nothing yet had been so far developed. One difficulty about the stopper lamp was that it would not hold the vaccum long and so that the lamp at the Fair had often to be renewed, but that they did, and on the whole it was a highly successful episode for the Westinghouse concern.

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It was demonstrated which established alternate current which today is the current which carries practically ninety-five percent of electric power of the country.

It was the lighting of the Chicago Fair - the most stupendous new development in this period was the development of the power at Niagara Falls. This project had been under consideration for some three years. The company had been developed had called in for counsel an International Niagara Commission made up of heading scientists of some five companies. The most sincere company was given to every project. Among those competing was of course Westinghouse.

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