See Purchasing Agents' Guide on page 571 :: :: :: ::

See Alphabetical Index to Advertisements on page 529

THE

Railway and Marine World

With which are incorporated The Western World and The Railway and Shipping World, Established 1890

Devoted to Steam and Electric Railway, Marine, Grain Elevator, Express, Telegraph, Telephone and Contractors' interests

Old Series, No. 242. New Series, No. 160 | TORONTO, CANADA, JUNE, 1911. | For Subscription Rates, See page 529.

Improvements in the Modern Locomotive.

By George Black, Road Foreman of Locomotives, G. T. R., Stratford, Ont.

In preparing this paper I have endeavored to give a review of the most important improvements in the modern locomotive brought about by the varying conditions and requirements from the time of its first appearance to the present time. In doing this I have been unable, in the limited time at my disposal, to give the exact dates of the introduction of the various improvements, but have trusted chiefly to my memory.

The first idea of steam navigation was set forth in a patent obtained in 1736 by Jonathan Hulls, for a machine for carrying vessels against wind and tide. In 1778 Thomas Paine proposed in America this application of steam. In 1781 the Marquis de Jouffray constructed one on the Seine, and in 1785 two Americans published descriptions of it.

In 1789, W. Symington made a voyage in one on the Forth and Clyde canal, and soon after Fulton visited Mr. Symington, took notes and then went to America and in 1807 started a steamboat on the Hudson River and made a success of it. In June 1819, the Savannah of 350 tons went from New York to Liverpool by steam. Steam power to convey coal on a railway was first used by Blenkinsop at Hunslet near Leeds, and afterwards for passengers and goods on the Stockton and Darlington Railway, the speed was from five to eight miles an hour.

In the trial of locomotive steam carriages at Liverpool, in October, 1829, Braithwaites' carriage, including water and fuel, weighed 8,220 lbs. Stephenson's weighed 9,216 lbs., and ran from 14 to 18 miles an hour. Braithwaites' ran 22 miles an hour, the size of the cylinder was six ins., the stroke 12 ins., and the load hauled was 10 tons. These figures are in striking contrast to the modern mastodon weighing 225 tons, and having cylinders of 36 ins. diameter, and 34 ins. stroke, and capable of hauling 4,000 tons or more, but it is a great tribute to Stephenson that we find on the great majority of the locomotives in service today the link motion for steam distribution invented by him, and the strange part of it is that we have not as yet found anything to beat it. Stephenson also saw the advantage of added weight to increase the traction power of an engine, and engines were made heavier and wheels were coupled in series to bring about this result.

Then we find another important matter to be considered, viz., the power to control and stop the engines and trains at the required time and place. This brought about the introduction of brakes, the first of these was of the crudest type and consisted of a block of wood attached to a long lever which, when not in use was hung on a hook, and when required was let down off the hook and exerted a retarding force on the wheel. The next thing was a brake operated by a crank, and a series of levers which did the service for a great many years until the introduction of power brakes, the first of which I believe was the vacuum brake which consisted of a series of suitable levers and a cylinder on each car and engine, and a pipe connecting all to an ejector on the engine. This ejector was capable of

H. B. Spencer,
Superintendent, District 4, Eastern Division, C.P.R.

creating a partial vacuum in the cylinders, and the pressure of the atmosphere acting on the opposite side of the piston caused it to move and exert a force through the levers, etc., to the wheels, and thus bring about the desired result, but this had the great disadvantage that when the pipe connection got broken or leaked or the train broke in two the brakes could not be operated. This condition brought about the introduction of the automatic vacuum which would overcome this difficulty, for when the train broke in two or the pipes of the brake were disconnected, the brakes would automatically apply and stop the train. The name of the inventor of this brake was Smith. About this time there were other brakes operated about in the same manner, some by steam and some by compressed air, but it remained for Geo. Westinghouse to give to the world the brake that has made possible the controlling of heavy trains at high speeds, and added the element of safety in handling the commerce of the country and the enormous amount of passengers that travel over the great railways of today. The first of these brakes, as I said before, was rather crude, but as time went on, the requirements were noted and met on all sides, so that from the beginning, with the brake only on the engine, and then applied to a few passenger cars, we now have brakes on every wheel of the train, whether passenger or freight.

When the Westinghouse automatic brake was first introduced we had the old style plain triple valves operated by a three way cock on the engine, and it was found that the operation on long trains was slow on the rear cars and quicker on the cars next to the engine, than when the flow of air from the train pipe was suddenly cut off by the abrupt closing of the three way cock by the engineer, the air would surge from the rear of the train and release the brakes on the front of the train and engine, and sometimes cause damage to draft gear. This brought about the introduction of the equalizing discharge valve, which, by its gradual opening and closing, made the brakes operate uniformly. Then again on longer trains with plain triples, the brakes in an emergency were too slow to apply on the rear of trains and this brought about the introduction of the quick action triples which operate so quickly that the brakes on the last cars are set before the slack has time to run in. Pump governors have also been put on to govern the pressure of air in main reservoirs, feed valves to regulate the pressure in train pipes and auxiliaries and reducing valves to regulate the brake cylinder pressures in the operation of high speed brakes, so that trains running at high speeds can be brought to a stand in the shortest possible distance without shock or the skidding of wheels.

The improvements which have been made to the modern locomotive, are of two classes, those which have been adopted on account of their mechanical advantages, and those which have been adopted to effect economy in steam consumption. The piston valve, the Walschaert valve gear, and the mechanical stoker belong to the first class, and will be considered in the above order. To the second class belong the compound engine and the superheater. These are, without doubt, the most important improvements made in the locomotive and have, with one exception, the Walschaert valve gear, been successfully developed within the last 15 years.

THE WALSCHAERT VALVE GEAR.

The real test which should be applied to every detail which is assumed to in-