HISTORY OF WALSCHAERTS' VALVE MOTION.

Translated from "Revue de Mecanique" by Lawford H. Fry.

EGIDE Walschaerts died on the 18th of February, 1901, at Saint-Gilles, near Brussels, at the age of 81 years. His mechanism, which is so original, has been adopted for many years in New Zealand and most of the countries of Europe, and has been wrongly attributed to Mr. Heusinger von Waldegg. He was born January 21, 1820, at Malines, which place became, fifteen years later, the central point of the system of Belgian Railways. The line from Brussels to Malines was opened in 1835, and this event decided the career of young Walschaerts. Three years later, at the exhibition of products of Malines, there appeared some remarkable models executed by him, and described as follows in the catalogue :—

No. 19. M. E. Walschaerts, jun., student of the Municipal College :

(*a*) A stationary steam engine of iron (the main piston having the diameter of 4.5cm., or 1.77in.).

(*b*) A working model of a locomotive in copper to the scale of 1-20 of the railway locomotives.

(*c*) Section of a stationary steam engine.

(*d*) Model of a suction pump and of a duplex pump.

(*e*) Class model of an inclined plane.

Minister Rogier was so much struck by it that he had Walschaerts enter the University of Liege, but his studies were interrupted by a serious illness, and were never completed. We find traces of him at the National Exhibition in Brussels in 1841. The report of the jury mentions with praise a small locomotive constructed entirely by Walschaerts, and a steamboat 6.50 metres long and 1.75 metres wide, which was capable of carrying sixteen men and travelling (so the report says) at four leagues an hour on the canal.

The boiler of this little boat was of a new system invented by the constructor. The jury does not give further details. Walschaerts received the silver medal.

In 1842 Walschaerts was taken into the shops of the State Railway at Malines as a mechanic.

Machine tools existed only in the most rudimentary forms, and the storerooms were badly provisioned. The lack of organisation in the shops rendered a man of Walschaerts' abilities particularly valuable, and at the end of two years he was made shop foreman at Brussels. Although he was only twenty-four years of age he had already shown the qualities which make an engineer, which should have carried him in a few years to be the technical head of the motive-power department. It is humiliating to be compelled to say that he remained shop foreman throughout his life.

The locomotives came from England, and had not been in service for more than ten years when Walschaerts was made foreman. The railroad was growing rapidly, and it was necessary to increase the forces and to acquire experience. Walschaerts was not content with the duties incurred in these difficult circumstances, but began his career by the invention of his system of valve motion.

On October 5, 1844, Mr. Fischer, engineer of the Belgian State Railways, filed for Egide Walschaerts an application for a patent relating to a new system of steam distribution applicable to stationary steam engines and to locomotives. This Belgian patent was issued on November 30, 1844, for a term of fifteen years. The rules of the department did not allow a foreman to exploit a Belgian patent for his own profit, and this explains probably the intervention of Mr. Fischer, who has never claimed the slightest part, material or moral, of the invention.

On October 25th of the same year Walschaerts took out a patent in France for the same invention There also exists among the documents left by the inventor, a contract signed at Brussels in 1845 by Demeuldre from which it appears that he undertook to obtain a patent of importation into Prussia for the new valve motion, subject to an assignment by Walschaerts of half of the profits to be deducted from the introduction of the new valve motion in England. It is probable, however, that this contract was never carried out.

The design attached to the Belgian patent is reproduced in Fig. 1 herewith. In this primitive arrangement the link oscillated on a fixed shaft, in regard to which it was symmetrical, but it had

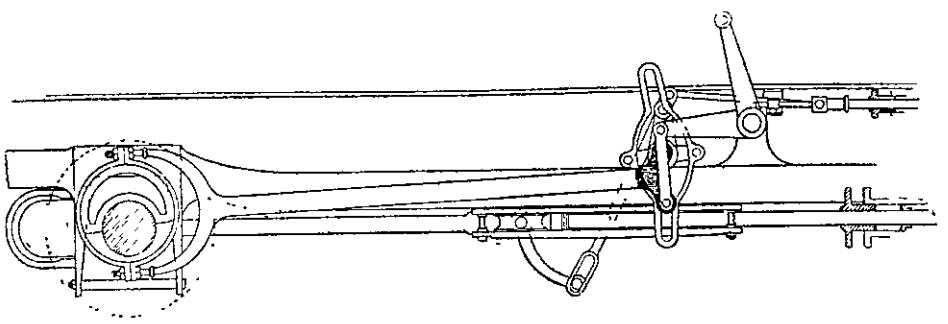


FIG. 1.

an enlarged opening at the centre so that only at the ends was it operated without play by the link block, which was made in the form of a simple pin. There was only one eccentric, the rod of which terminated in a short T carrying two pins. The reverse shaft operated the eccentric rod and maintained it at the desired height. For one direction the lower pin of the T engaged in the lower end of the link. The angle of oscillation of the link varied with the position of the pin in the link, and this oscillation was transmitted by an arm to the combining lever, which was also operated by the crosshead.

The central part of the link could not be used for the steam distribution as it was necessary to enlarge it to allow for the play of the pin which was not in operation. It may be asked why the inventor used to separate pins mounted on a crosspiece on the end of the eccentric rod instead of a single pin on the centre of the rod, which would have served for both forward and backward motion without requiring the centre enlargement of the link. It must be borne in mind that the raising or lowering of the eccentric rod by the reverse shaft was equivalent to a slight change in the angular advance of the eccentric. Consequently, with the link of a sufficient length to keep down the effect of the angularity, it was necessary to reduce as much as possible the movement of the eccentric rod. Notwithstanding its differences the mechanism described in the patent of 1844 is in principle similar to the valve motion with which everyone is to-day familiar, and which the inventor constructed as early as 1848,

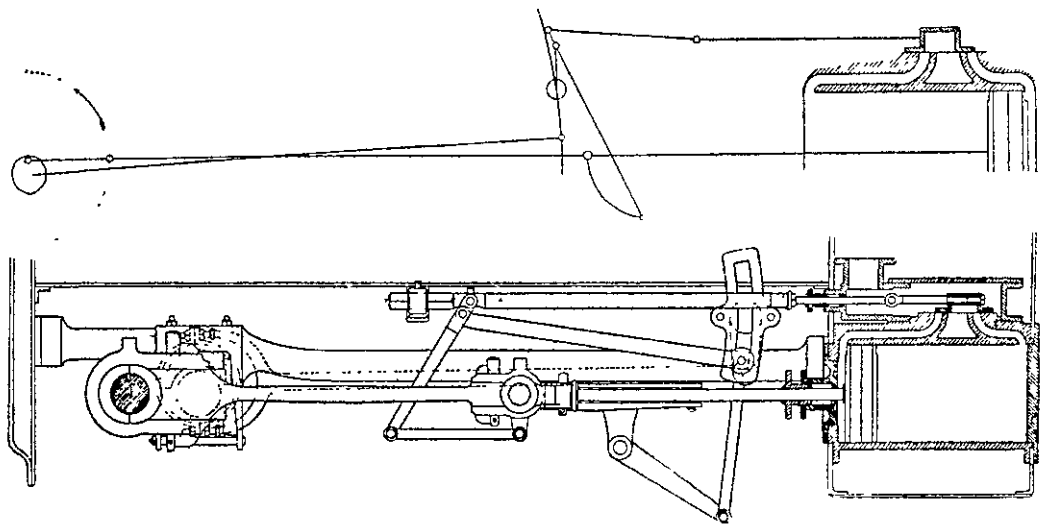


FIG 2.

as is shown by a drawing taken from the records of the Brussels shops on which appears the inscription "Variable expansion ; E. Walschaerts' system applied to Locomotive No. 98, Brussels, September 2 1848."

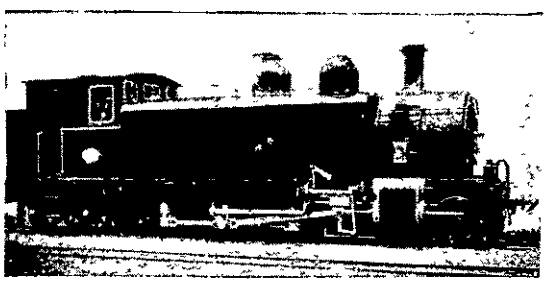
Fig 2, taken from this drawing, shows the valve motion as we know it to-day For although it is true that the link and the combining lever are usually placed in a different position so as to shorten the eccentric rod and the valve stem, yet the design of the locomotive often requires an arrangement similar to that shown herewith. The system which Mr. Heusinger von Waldegg invented in 1849, and which he applied in 1850 and 1851, differs only in a few insignificant particulars from that shown in Fig. 2. Walschaerts had therefore preceded Von Waldegg.

There are now innumerable systems of steam distribution, and the progress made in kinematics has greatly facilitated their development. At the time, however, of Walschaerts' work there was only one system of valve motion which was at all extensively used—namely, that of Sharp, with two eccentrics with forked rods. The link attributed to Stephenson was invented by Howe in 1843, and it is doubtful whether Walschaerts had ever seen it. A problem which nowadays appears very simple, was for the investigators of that time extremely complicated, and the man who discovered the most correct solution which has yet been put forward merits unreserved admiration.

Notwithstanding his work at the Brussels shops, where he built, with limited equipment, several new locomotives, Walschaerts did not lose sight of the problem of steam navigation, and appeared at the National Exposition at Brussels in 1847 with a screw yacht which ran successfully. The propeller had several blades, each one with only a small part of the thread similar to those of the modern screws. Walschaerts had invented this arrangement himself, without knowing of the results obtained by Normand with the Corse in 1841 or 1842. Locomotive practice had taught him the intimate correlation which should exist between the engine and the boiler, and in this machine he made use of a boiler of high power which attracted much attention. A similar machine was built a little later by the Couillet Company, as is shown by the plan drawn up in 1853. This machine is compact and light. The documents which remain do not mention the pressure or the speed. It was non-condensing, and in all probability the exhaust steam assisted the draught.

During the years which followed, Walschaerts' activity was given entirely to his duties as foreman, and it is difficult to determine his part, which was valuable, though anonymous, in the design of the railroad equipment. He is credited with the differential throttle in which the opening of an auxiliary slide on the back of the main slide assisted the opening of the valve. He also designed a brake with shoes acting on the rails which was used for a long time in switching locomotives, and in which the principle of a lever acting near its dead point was applied in an ingenious manner.

It was very remarkable that his initiative spirit did not suffer from his long services under an administration with so much complicated routine. It is possible that he found a stimulant in the adoption of a large number of his ideas by the Great Central Belgian Railway, and in encouragements which, without making him rich, kept his intelligence on the alert. He took an important part for many years in the design of the motive power of this railroad, which was rendered the more difficult by reason of the hard profile of the lines terminating in Charleroi and by the heavy traffic to be handled. The design of the freight locomotives for heavy grades, built in 1862 for the Great Central, belongs entirely to Walschaerts. The company built more than one hundred locomotives from the original plans without making any important alterations. These locomotives have not been without their influence



WALSCHAERTS' VALVE GEAR FITTED TO A NEW ZEALAND LOCOMOTIVE.

on the Belgian shops in which they were built. They have left behind them traditions, of which traces are found in a large number of engines exported to various countries of Europe.