third divided into small subdivisions to any terminals of which the cross circuit connexions may be affixed. By this arrangement of the coil winding, similar sections can be thrown in or out of circuit with both arms, and also so combined that any amount of inductance suitable to every class of cable may be obtained. The bridge is provided with two adjustments:—(1) a variable “ apex,' having several turns of the winding between each stud to permit of the arms being thrown slightly out of balance as a rough compensa­tion for the differences in the cable and artificial line; and (2) an additional “ fine" adjustment in one of the arms by which the small daily balance variations may be corrected. As with other duplex systems it is possible to obtain several approximately correct adjust­ments with the bridge and its accessories, but only one gives a true balance, and careful experiment is required to make sure that this is obtained. The advantage of using the magnetic bridge duplex method is that the maximum current is sent to line or cable, and the receiving system benefits accordingly. (H. R. K.)

Commercial Aspects.

. The earliest practical trial of electrical telegraphy was made in 1837 on the London and North Western Railway, and the first public line under the patent of Wheatstone and Cooke was laid from Paddington to Slough on the Great Western Railway in 1843. At first the use of the telegraph was almost entirely confined to railways. The Electric Telegraph Company, formed to undertake the business of transmitting telegrams, was incorporated in 1846. For some time it restricted its operations to constructing and maintaining railway telegraphs and was not commercially successful. Its tariff was 1s. for 20 words within a radius of 50 miles, 1s. 6d. within 100 miles, 5s. if exceeding 100 miles. After about five years great improvements were made in the working of the telegraphs and the industry began to make progress. Telegraphic money orders were established in 1850; a cable was laid between Dover and Calais, and in November 1851 the stock exchanges of London and Paris were able for the first time to compare prices during business hours of the same day; numerous companies were formed, some of which were independent of the railways, and keen competition led to considerable extensions of wires and reduction of tariffs, with the result that a large increase in the volume of business took place. In the period from 1855 to 1868 the number of messages carried annually by all the telegraph companies of the United Kingdom increased from 1,017,529 to 5,781,989, or an average annual increase of 16·36 per cent. During this period the Electric Telegraph Company’s average receipts per message fell from 4s. 1¼d. to 2s. 0¾d., or just over half, while the number of messages increased nearly fourfold. The working expenses were reduced in a progressively larger ratio, *e.g.* in 1859 the average working expenses were 2s. 7d. per message or more than 65 per cent. of the receipts, while in 1869 they were 1s. 0¼d. per message or only 51 per cent. of the receipts. Much dissatis­faction was felt because the larger towns where competition had been most keen were unduly benefited to the neglect of smaller towns where the business was comparatively less profit­able, but it must be remembered that the telegraph lines followed the railways and that many towns were not served owing to their opposition to the railways.

In 1856 the Edinburgh Chamber of Commerce began an agitation for the purchase by the government of the telegraphs, and other chambers of commerce in Great Britain joined the agitation, which was strongly supported by the Press. In 1865 the Postmaster-General (Lord Stanley) commissioned Mr F. T. Scudamore, second secretary to the Post Office, to inquire and report whether the electric telegraph service could be bene­ficially worked by the Post Office, and whether it would entail any very large expenditure on the Post Office beyond the purchase of the rights. At that time the total number of places supplied with telegraphic communication by all the companies collectively, including railway stations, was 2500, whereas the number of places having postal communications was over 10,000. Under the then existing telegraphic tariff the charge in Great Britain was a shilling for a twenty-word message over a distance not exceeding 100 miles ; 1s. 6d. for a like message over distances from 100 to 200 miles; 2s. when exceeding 500 miles. For a message between Great Britain and Ireland the charge ranged from 3s. to 6s.; to Jersey or Guernsey it was 7s. 8d. There were also extra charges under contingent re­gulations of great complexity, which commonly added 50 per cent. to the primary charge, and frequently doubled it. Mr Scudamore, who was regarded as the author of the bill for the acquisition of the telegraph systems, reported that the charges made by the telegraph companies were too high and tended to check the growth of telegraphy; that there were frequent delays of messages; that many important districts were unprovided with facilities; that in many places the telegraph office was inconveniently remote from the centre of business and was open for too small a portion of the day; that little or no improvement could be expected so long as the working of the telegraphs was conducted by commercial companies striving chiefly to earn a dividend and engaged in wasteful competition with each other; that the growth of telegraphy had been greatly stimulated in Belgium and Switzer­land by the annexation of the telegraphs to the Post Offices of those countries and the consequent adoption of a low scale of charges; that in Great Britain like results would follow the adoption of like means, and that the association of the tele­graphs with the Post Office would produce great advantage to the public and ultimately a large revenue to the state.

In support of these views he reported that in Belgium in 1863 a reduction of 33 per cent. in the charge had been followed by an increase of 80 per cent. in the number of telegrams, and that in 1886 a reduction of 50 per cent. in the charge had been followed by an increase of 85 per cent. in the traffic; and similar statistics pointing to increase of business consequent on reduc­tion of rates were produced in regard to France, Switzerland and Prussia. The relative backwardness of telegraphy in Great Britain was attributed to high charges made by the companies and to restricted facilities. Some of the complaints against the companies, however, were exaggerated, and the. estimates formed of the possible commercial development of telegraphy were optimistic. The basis for these estimates was the experi­ence of other countries, which, however, did not justify the expectation that a large increase of business consequent on reduction of rates could be obtained without serious diminution of profit. The Belgian state telegraphs were started in 1850 and were at first very profitable, but for the years 1866-9 they yielded an average profit of only 2∙8 per cent., and subsequently failed to earn operating expenses, the reasons for the steady decline of the profits being the opening of relatively unpro­fitable lines and offices, increases in wages, and a diminution in growth of the foreign and transit messages which had con­stituted the most profitable part of the whole business. The Belgian government endeavoured by reducing rates and increas­ing facilities to stimulate inland telegraphy in the hope of thereby increasing the profits of the department. But these expectations were not realized. Upwards of 100 telegraph offices in Belgium despatched on the average less than one telegram per day, and some offices despatched less than one a month. Similar experience was adduced by the working of the state telegraphs in Switzerland and in France. The profits when earned were derived mainly from foreign messages and transit messages between foreign countries, while the receipts from inland messages did not always cover expenses. In 1868 there were in France over 300 telegraph offices whose average receipts did not exceed £8 per annum. In that year the Swiss government reduced the rate for inland telegrams by one-half, and the traffic immediately doubled, but the cost of carrying on the service increased in a larger ratio.

The experience of the telegraph companies in the United Kingdom, moreover, showed that a uniform rate, irrespective of distance, of 1s. for 20 words, addressed free, was not remunera­tive in the then state of telegraphy, which made it necessary for messages to be re-transmitted at intervals of about 3∞ miles. In 1861 the United Kingdom Telegraph Company began a competition with the other companies on the basis of a 1s. rate, and the old-established companies were forced to adopt this rate between all points served by the United Kingdom