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SCOTTISH CANALS
AND WATERWAYS

EDWIN A. PRATT



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COMPRISING

State Canals, Railway-owned Canals and Present-Day Ship Canal Schemes

BY

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PREFACE.

SCOTTISH CANALS have in certain respects distinctive features which render them essentially different from English canals, while for various reasons constituting either points of interest or matters of controversy they are specially deserving of study and attention at the present time.

Of the five existing canals here coming under consideration, three, namely, the Caledonian, the Forth and Clyde and the Crinan, are one and all sea-to-sea canals, of a type non-existent in England as distinct from Scotland ; and of the two others, the Monkland and the Edinburgh and Glasgow Union, the former is a branch, and the latter a connection, of the Forth and Clyde Navigation.

Two of the five, the Caledonian and the Crinan, are both of them owned and operated by the State, presenting conditions once more unknown south of the Tweed ; and their history constitutes a remarkable and instructive object lesson from the point of view of the demands made from time to time for the nationalisation and transfer to State or municipal control of British canals and waterways in general.

The three other canals—the Forth and Clyde, the Monkland and the Edinburgh and Glasgow Union—are all owned by railway companies ; and here the points of special importance are the differences presented between State control and private enterprise and the question as to why it is that canals which have been well maintained and run through industrial districts offering, apparently, every prospect of success, have had to face a constantly diminishing traffic in spite of all that their owners, if only in their own interests, have found it possible or practicable to do in order to secure from them a maximum of attainable revenue towards, at least, the cost of upkeep. The reasons for such decline in traffic go to the very root of the British Canal Problem of to-day ; and nowhere, perhaps, can the main solution of this problem be found with greater clearness and conviction than in the experiences, as here detailed, of the three canals in question.

The account given of each of the canals dealt with has necessarily involved a considerable amount of research. In the case of the Forth and Clyde Navigation, the " Junction of the Eastern and Western Seas," as it was called at the time, was effected on July 28th, 1790. The Monkland Canal was opened throughout in 1792. The Crinan Canal dates from 1801, and the two others are both attaining their centenary this year, the

Edinburgh and Glasgow having been opened for traffic on May 12th, 1822, and the Caledonian on October 24th, 1822. In each instance it has been found expedient to trace the course of events leading up to the initiation of the undertaking and to offer an outline of its subsequent history down to present date, so that the situation as a whole may be understood.

With three of the canals, also, there are now associated, directly or indirectly, ship canal schemes which, in the aggregate, would involve the expenditure of a vast sum of money, the estimated cost of one alone of the series being £57,573,000. The schemes relating to the Caledonian are for a more or less complete reconstruction of the existing waterway. The Crinan Ship Canal would be a new undertaking, save for the absorption of a portion of the present smaller canal. For a ship canal connecting the Forth and the Clyde two routes have been proposed, known respectively as the Loch Lomond Route and the "Direct Route," the latter being almost parallel to that of the existing Forth and Clyde barge canal, though entirely independent thereof.

So far as regards the Crinan Ship Canal, the questions concerned form a comparatively simple proposition, and one that stands alone except in so far that any modernising of the transport facilities on the Crinan would also improve the prospects of the Caledonian. As regards the other ship canal schemes—all antagonistic, more or less, the one to the others—the situation is complex in the extreme. Strategical, commercial and financial considerations; the rivalries, the hopes, the fears and the aspirations of particular cities, ports and places; the varied interests of engineers, shipowners, traders, landowners and tax-payers, together with those of Scotland and of the nation; the questions as to whether (on the Caledonian as well as on the Crinan) expenditure on improvements would not be preferable to expenditure merely on repairs, and as to what is expedient in the public interests—if not as a matter of national reconstruction—and what is in no way really essential at a time when all possible regard must be shown for economy; the putting forward, on the one hand, in regard to new undertakings, of predictions of possible traffic which, on the other hand, are declared to be wholly delusive—in all these things there are elements of controversy and direct contradiction which may reduce almost to despair the unaided citizen who feels that, whatever is done, it is the tax-payers of the country who will run the risk of having to pay the bill!

What, therefore, has here been aimed at is to give, in each instance and in the simplest and clearest form, THE FACTS OF THE CASE, in order that readers may have some help in arriving at a decision for themselves on the questions at issue—whether they concur in the Author's own conclusions or otherwise.

The said facts, covering all the present and prospective canals and

waterways concerned, would certainly be difficult of ascertainment by the average person, and it is hoped that the series of short stories here told, together with the collection of maps and diagrams specially prepared for this work, will be found, not alone of interest, but of practical service when, possibly in the not-far-distant future, the matters dealt with again arise for public discussion.

The present volume will more especially afford to its readers the means of discriminating between a modest, unpretending and comparatively inexpensive proposal which, if carried out, should have a powerful effect in promoting the social and economic welfare of the Western Highlands and Islands—already for so long awaiting fuller development—and a much-discussed impracticable scheme likely to yield only very doubtful results and certain to lead the country into what I have ventured to call a “bottomless pit” of public expenditure.

It might, perhaps, be added that the work here offered to the public should be of still greater utility by reason of the action which, following on a recommendation by the Geddes Committee, has now been taken by the Ministry of Transport in inquiring from the Inverness-shire and Argyll County Councils if they would be prepared to take over the Caledonian and Crinan Canals respectively.

The matter is dealt with briefly in the concluding paragraphs of the “Postscript” (p. 283); but it may here be suggested that the immediate question, if the Councils were prepared to entertain the proposal at all, would be as to the nature of the terms and conditions on which the transfer in each instance should be effected.

One may fairly assume that, before the Inverness-shire County Council took over the Caledonian Canal, they would want a very comprehensive guarantee from the Government of the cost of repairs, working, and maintenance; and what this might possibly mean is suggested by the fact that the general repair carried out in 1920 involved a special Government grant of £11,000, while, according to a recent report in the *Scotsman*, the House of Commons was to be asked, in the Session of 1922, for a supplementary vote of £15,000 to meet the working deficit on the Caledonian for the financial year. The present financial position of the canal is, in fact, that the expenditure has far exceeded the revenue for the last nine years, and that, although the tourist traffic in 1922 has already attained record proportions, the former balances of revenue over expenditure are not likely to be restored so long as the existing depression in the fishing industry continues.

Any Government guarantee of the cost of repairs, working, and maintenance, etc., would, again, make no provision for the carrying out of one or other of those reconstruction schemes of which an account is given on pp. 42-5; and although, pending the necessary surveys, the probable cost of those schemes is the merest guess-work, that of “Scheme A”

might, provisionally, be put at about £8,000,000, and that of " Scheme B " at about £6,000,000.

The Inverness-shire County Council may, therefore, well be expected to ask where they would stand in all these matters before they accepted responsibility for the future of the canal.

As for the Crinan Canal, we have the representations which have been made by or on behalf of the Argyll County Council to the effect that the expenditure of any substantial sum for repairs and maintenance, without an increase in transport facilities, on a canal already a century out of date would be a waste of public money, and there is no reason whatever for supposing that the Council would agree to take over the waterway until it had been converted into a modern ship canal on the lines they have repeatedly declared to be essential both to its efficiency and to the meeting of present-day requirements.

On the other hand, one must bear in mind that the express purpose of the Geddes Committee was to effect a reduction in public expenditure, and the recommendations they made concerning the canals in question were, presumably, designed to relieve the Government of their financial obligations in connection therewith. If, therefore, the County Councils should, as a condition of their acceptance of the proposals now being brought under their notice by the Ministry of Transport, stipulate for some such guarantees as those here mentioned, the Government would still be faced by the main portion of that expenditure which they are now seeking to avoid, and the Treasury might demur accordingly. It would then remain for Parliament to say what the future of these two State-owned canals should really be.

EDWIN A. PRATT.

AUGUST, 1922.

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PART I.—STATE-OWNED CANALS.

tinuation of the Firth of Lorne, comes inland from the Atlantic, for a distance of thirty-two miles (with an average width of about two miles), from the Sound of Mull to Corpach (near Fort William), where Loch Eil diverges on the north-west.

These fifty-two miles of sea lochs at either end of the Great Glen are supplemented by an intermediate chain of three fresh-water lakes having a total length of thirty-eight miles, namely, Loch Ness, twenty-four miles, Loch Oich, four miles, and Loch Lochy, ten miles. Between these fresh-water lakes themselves, and, also, between the series of them and the sea-water lochs, are stretches of land having an aggregate length of twenty-three miles, as aforesaid. No more, therefore, than the construction of an artificial canal along these intervening spaces seemed to be needed to link up the sea lochs and the lakes, and so create a navigable highway passing through the Great Glen for its full extent.

Nature herself having done so much, there might have been thought to be very little left for man to do to complete the work.

Such a highway, connecting two much-frequented oceans, had, indeed, long been predicted by visionaries or discussed by practical persons.

The Brahan Seer, Conneach Odhar, is reported to have said as early as the beginning of the seventeenth century :—" Strange as it may seem to you this day, the time will come, and it is not far off, when full-rigged ships will be seen sailing eastward and westward by Muirtown and Tomnahurich."¹ The question as to the construction of a Caledonian Canal was referred to by Edward Burt in his " Letters from a Gentleman in the North of Scotland to his Friend in London," published in 1754.² In Letter XXVI of the series, headed " Concerning the New Roads, etc.," and bearing date " 173-," Burt describes the country between Inverness and Fort William, states that the stretches of land between the lochs have a total length of fourteen miles, and continues :—

About the Middle of the Neck of Land, that divides the Lakes *Oick* and *Lochy*, (which is but one Mile) not far from the Center of the Opening, there descends from the Hills, on the South-Side, a Bourne or Rivulet, which, as it falls upon the Plain, divides into two streams, without any visible Ridge to part them. And one of them runs through the Lakes Oick and Ness into the East-Sea, and the other takes the quite contrary Course, and passes through Loch Lochy, into the Western Ocean.

This, and the short Space of Land abovementioned, have given birth to several projects for a navigable Communication across the Island ; not only to divide, effectually, the Highlands by the Middle, but to save the tedious, costly and hazardous Voyages through St. *George's* Channel, or otherwise round by the Isles of *Orkney*.

This Spot the Projectors say is a Level between the two Seas, pointed out as it were by the Hand of Nature ; and they pretend the Space of Land to be cut through is practicable.

¹ " Notes on the Formation of the Caledonian Canal." By Alex. Ross. " Transactions of the Gaelic Society of Inverness." Vol. XIII, 1886-7. Muirtown is situated at the eastern end of the Caledonian Canal. Tomnahurich is a wooded height on the outskirts of Inverness, now used as a cemetery.

² In a fifth edition of these " Letters," with Notes, issued in 1818, it is said :—" The author is commonly understood to have been Captain Burt, an officer of engineers who, about 1730, was sent to Scotland as a contractor, etc."

But it would be an incredible expence to cut fourteen navigable Miles in so rocky a Country, and there is yet a stronger Objection, which is, that the whole Opening lies in so direct a Line, and the Mountains that bound it, are so high, the Wind is confined in its Passage as it were in the Nozel of a Pair of Bellows ; so that, let it blow from what Quarter it will, without the Openings, it never varies much from East to West within.

This would render the Navigation so precarious, that hardly any Body would venture on it, not to mention the violent Flurries of Wind that rush upon the Lakes by Squalls from the Spaces between the Hills, and also the rocky Shores, want of Harbour and Anchorage ; and perhaps there might appear other unforeseen Inconveniences and Dangers, if it were possible the Work could be completed.

EARLY PROJECTS.

One gathers from Edward Burt's references that several projects for the building of a canal had already been put forward by about the year 1730 ; but nothing definite in the way of testing their practicability seems to have been done until 1773.

In May of that year Dr. William Small, a Scotsman, and partner of Matthew Boulton, founder of the famous works and mint at Soho, near Birmingham, wrote to James Watt, then a land surveyor resident in Glasgow, suggesting that he should make a survey of " a passage for ships from Inverness to the Western Sea." Watt replied that he knew something about the matter, and that the survey would cost much time and money. " I am afraid," he further said, " the estimate would frighten you." Dr. Small urged the proposal upon him, saying :—" The object is of great importance and is tolerably well understood to be so, and may be further explained so as to be rendered popular." On August 17th, 1773, Watt wrote to Dr. Small :—" I am appointed by the Court of Police to make a survey of the canal from Inverness to Fort William, and set out the week after next. I accept of this merely in consequence of your desire. Otherwise I should have delayed it till next session."

In a further letter to Watt on September 29th, 1773, Dr. Small said concerning the projected canal :—

When the herring-fishery was attempted by the people on the eastern coast they found their own sea furnished neither plenty of the fish nor fat ones ; therefor they tried to send vessels to the Western Sea. At the best season these ships could seldom get round by the Orkneys, on account of periodical westerly winds and currents ; and the voyage through the two channels is long and dangerous. Had the canal then existed, I believe the fishery would by this time have been established ; and for want of it, besides the disappointment in that contingency, a vast number of the fishing people that used to swarm upon the eastern coast have now left the Kingdom, the people having changed their diet and now using less fish. Besides, it was necessary, on account of the nature of the voyage, to use too large and expensive vessels.

Next, could a canal be made to admit armed vessels, no enemy could ever venture into the Irish Channel or near the Western Isles.

The returning voyage, even to London from America, would be shortened one-third upon an average, by steering round the North of Ireland for this canal, on account of the wind in those latitudes. The banks of the canal would prove a seminary of herring-fishers, whale-fishers and Newfoundland-fishers, for canals tend more to breed watermen than even sea-towns.

More artisans living on the eastern coast of Scotland than on the western, and they daily growing more expert, they would have more easy access to the American market, the only one that is likely to be long supplied with manufactures from Britain &c., &c., besides all the inland advantages.

In the report he subsequently presented, under date March 1774, Watt wrote concerning the general merits of the scheme :—

All vessels going from Ireland, or the west coasts of Britain, to the east coasts of the island, to Holland, or to the continent of Europe north of it or *vice versa*, together with vessels trading between the east coast and America, must either pass through the British Channel, or go north-about, that is, through the Pentland Firth, or through the Sounds of, or round the Orkney Islands: At all times going north-about, is the readiest passage for the northern parts of the island; and in time of war the danger from privateers in the British Channel, and the high insurance upon that account, are so great, that many ships, to which that passage would naturally be convenient, are obliged for security or economy to go north-about.

Wherever a great promontory or termination of a main-land is to be passed round or doubled, it is well known to mariners that, from the variety of winds that are necessary, and from the storms which rage with greater fury at those headlands than upon other coasts, the voyage is more tedious, as well as more dangerous than others of a like length that lie in a direct course. This is remarkably the case with the Orkney passages, to which the northern situation greatly contributes. Besides other inconveniences, they are subjected to periodical winds that blow violently for months together from the east or west, which renders it not uncommon for vessels to be detained six weeks or two months in those harbours. In the winter season, the risk of shipwreck on these boistrous seas is very great, and consequently the passage is little frequented then, and the insurances are high. The greatest loss of time in the northern passage generally happens about the Orkneys, as it is there that the winds which brought the vessels northward cease to be of any further service to them, and the seas are generally too stormy to permit them to work to windward.

From this view of the subject, it appears that a communication such as is here described, between the German Ocean and Atlantic which would be shorter, more secure, both from the dangers of the sea and from privateers, and also more certain in all seasons than that by the Orkneys, would be more acceptable to all vessels capable of passing through it, even though it were loaded with a toll.

As the result of his survey, Watt said he regarded the construction of a canal to be practicable; though survey and estimates were alike based by him on the assumption that the canal would have a depth of only 10 ft., since he knew of no canal, he said, which had been executed on a greater scale. "It is sufficient in a first survey," he wrote, "that the possibility is established and the expense of one mode of communication is nearly estimated, which I flatter myself I have done." The instructions, also, which he received required him to give an estimate for a canal intended principally for sea-going vessels drawing nine feet of water, and, at the same time, to examine how far one of a larger size might be "eligible or advantageous." His estimate for a canal 59 miles long, of the depth stated, and having thirty-two locks, each 90 ft. long by 25 ft. wide, with a fall or rise not exceeding 7 ft., was £164,000.¹ No action, however, was taken on his report.

¹ The full text of Watt's report will be found in Appendix 22 (pp. 115-123) of the Third Report (presented July, 1785), from the Committee appointed to enquire into the state of the British Fisheries, Reports of the House of Commons, Vol. X.

In 1793 a scheme for the same project was prepared by Rennie, who, in doing so, consulted with Watt; but once again nothing was done.

JOHN KNOX AND THE CALEDONIAN CANAL.

Meanwhile the construction of a Caledonian Canal was being warmly advocated in still another direction.

John Knox (1720-1790), a native of Scotland, and for many years a bookseller in the Strand, London, retired from business in 1764 after having made a large fortune, and thenceforward devoted himself to philanthropic efforts in the direction of advancing the economic and social conditions of Scotland, and more especially of the Highlands, by means of improvements in the fisheries and manufactures. He was a leading member of a British Society formed in Scotland for the extension of the fisheries and the betterment of coastal conditions in general. This Society was incorporated by Act of Parliament in 1786. Knox published, in 1784, "A View of the British Empire, more especially Scotland, with some Proposals for the Improvement of that Country, the Extension of its Fisheries and the Relief of the People." A "third edition, greatly enlarged," and in two volumes, followed in 1785. Dealing with the prevalent distress among Highlanders and the possibilities of developing the fisheries, he wrote:—"The inhabitants of these neglected shores, unable to avail themselves of the bounty which their seas afford, have lived in penury amidst the sources of affluence. I shall therefore specify such measures as seem most conducive to the purposes of general utility in the full establishment of a populous thriving colony. The first object which presents itself is the opening shorter communications between the Atlantic and the British Sea; the advantages of which are so obvious that they may be considered the groundwork of all succeeding improvements, not only in the Highlands but over Scotland in general." These shorter communications of which, he said, the country admitted, consisted of three artificial navigations, namely, a southern navigation, between the Forth and the Clyde; a western navigation, between the Clyde, or Loch Fyne, and the Atlantic, and a northern navigation, between Fort William and Inverness. "The three canals here recommended would," he declared, "open up a circumnavigation within the heart of the kingdom to the unspeakable benefit of commerce and the fisheries."

In dealing with the northern navigation, here recommended, he said that—

Between the Island of Mull and the Moray Firth there is a level or chasm composed of land and water which separates the mountains of the middle and northern divisions so completely that, with very small assistance from art, ships might pass between them from sea to sea.

From a shipping point of view he predicted that the benefits of such a canal would extend more or less to the whole southern coast of Scotland,

to Liverpool, Bristol and Ireland, and, also, to vessels trading with the Baltic which would be unable to use the shallow canal between the Forth and Clyde. He especially emphasized the value of the proposed waterway to the fishing industry, and he further spoke of the services that might be rendered to national interests, saying :—

The facility of this conveyance to the army is also obvious. Here is a chain of modern fortresses, viz., Fort George, at the east end of the pass ; Fort Augustus, in the centre, and Fort William, on the west, which serve, particularly in time of war, as barracks and magazines, from whence detachments of the army may be ready to start at the shortest notice. By means of this navigation, therefore, a short, safe and commodious military intercourse may be kept up between these detachments and also between the two seas upon the opposite sides of the island which no enemy could annoy or interrupt.

In the same year (1785) in which he published the third edition of his book, Knox gave evidence before a Committee which had been appointed by the House of Commons to inquire into the subject of British Fisheries. Recommending to their consideration all three of the canals he favoured, he said of the one between Fort William and Inverness that he travelled over the greater part of the ground several years earlier ; that he was persuaded a communication at this place between the two seas was practicable, and that it would offer advantages for the fisheries and the army in addition to facilitating intercourse between the more cultivated and the ruder parts of those northern countries. The only possible drawback he was able to suggest was that “ the expense would be very considerable.”

Knox's views and recommendations were supported by the Committee in the report they made to Parliament ; but once more no action was taken.

THE HIGHLAND SOCIETY.

Support for the proposals put forward also came from the Highland Society of Scotland, formed in Edinburgh in 1784 for the purpose of, among other objects, inquiring into the measures which could be taken for improving the conditions in the Highlands by facilitating the means of communication there. In furtherance, doubtless, of this aim, there was given in Vol. I of the society's “ Prize Essays and Transactions ” (Edinburgh : 1799) a paper of 40 pp. by the Rev. James Headrick “ On the practicability, and advantage, of opening a navigation between the Murray Firth, at Inverness, and Loch Eil, at Fort William.” The writer of the paper was of opinion that there were no physical obstacles to the cutting of such a navigation, and he detailed the advantages likely to accrue therefrom in developing the internal resources—more especially as regarded the improvement of agriculture, the establishment of manufactures, the utilization of timber supplies and the working of minerals—of the district through which it would pass, and, also, in the offering of increased facilities for the development of fisheries, coasting trade and foreign commerce.

THE EMIGRATION MOVEMENT.

The real impulse, however, that led at the end of the eighteenth and the beginning of the nineteenth century to definite action for the carrying out of a project which had then been under consideration for at least seventy years was based on conditions differing from those already mentioned.

In the first place the wars with Napoleon had suggested that a waterway through the Great Glen of Scotland, offering a safe connection between the two seas, would be of special advantage in enabling British ships to avoid attacks by French privateers when passing from one side of Britain to the other.

In the next place there had been, and there was still proceeding, a great stream of emigration from the Highlands to America owing to the fact that the conversion of considerable areas into sheep-walks or stock-farms had deprived a large proportion of the inhabitants of their means of subsistence, and had led to such a resort to emigration that many portions of the Highlands were threatened with actual depopulation.

Knox had himself given this fact as a reason for the construction of an artificial navigation between Fort William and Inverness. "In no part of the Highlands," he wrote, "hath the spirit of emigration been more severely felt by the landholders. Whole districts have been laid waste as by a plague; and unless some inducement shall be held out to these discontented natives, that great division of the kingdom will soon be desolated." To show that these fears were in no way imaginary, he mentioned that since 1763 over 30,000 Highlanders had left their homes for America, apart from the people who had also gone there from the Lowlands. The outlook thus presented was, indeed, a cause of serious alarm to the political economists of the day.

How this emigration movement, which was affecting so profoundly the social and economic conditions of the Highlands, had originated, was thus told in a "Letter from a Freeholder of Inverness-shire to Lord Adam Gordon, dated, 15th March, 1792, on cutting a canal between Inverness and Fort William," also published in Vol. I of the "Prize Essays and Transactions of the Highland Society of Scotland," spoken of above:—

In compliance with your Lordship's requisition, I have now the honour of transmitting to you what has occurred to me, with regard to the expediency and utility of cutting a navigable canal betwixt the Murray Firth, at Inverness, and the Bay of the Western Sea, at Fort William.

The North Highlands of Scotland have, for several years past, been considered an object of importance to the Government; and have, since that period, proved an useful nursery of his Majesty's army.

The first step towards its civilization, and improvement, proceeded from the several roads of communication, formed and upheld by Government, in these countries; this having, in some degree, opened an easy intercourse betwixt the inhabitants thereof, and those of the southern and eastern parts of Scotland and of England, had removed the prejudices which formerly narrowed their minds, and fascinated them to clannish predilection and subordination.

It led them also to the plan of forming roads in the internal parts of their country, from which they have reaped various advantages.

The unavoidable consequence of these improvements has been, that the natives now feel wants and inconveniences which formerly gave them no uneasiness, and that it has, in some measure, diminished their local attachments; and if, in the present conjuncture, some mode is not adopted for enabling them to procure more readily, in their own country, the necessaries and conveniences of life, the natives are left in a more deplorable situation than before the commencement of the improvements. For tho' the produce of their own country supplied their wants, when these were few and simple, and when their great leaders placed a higher value on a number of dependents than on the extent of a rent-roll; yet now that their great men have relinquished those ideas, and find it to their interest to enlarge farms and to let the same under a sheep-stock, it is obvious, that if something is not done for their relief, the small tenants will be under the necessity of abandoning their native country. In vain will any restrictions, which may be imposed, either by the legislative body, or private societies, remedy the growing evil of emigration. Mankind cannot, with any degree of justice, be compelled to reside in a country where their wants cannot be supplied, merely because it has been inhabited by their ancestors.

But if it can be shown that expedients may be adopted, to enable them to live nearly as comfortable in their own, as in any other country, there is something in the nature of man, and in that of Highlanders in particular, that disinclines them from emigration.

It was an idea long entertained by the inhabitants of the North that their hills and climate were solely calculated for raising black cattle; and they had such an inherent prejudice against sheep, and every branch of manufacture, that the few sheep kept by them were left solely to the charge of the women; and in every matrimonial bargain, they were allotted as an appendix to the widow's division of the effects.

It has now, however, been discovered that sheep can be reared with much less expence, and are much more productive, and capable of enduring the severity of the climate, than black cattle; and the natives themselves seem to prefer them.

The introduction of this system did not proceed either from the avarice, or the necessities, of the landholders: it originated from the intercourse opened to the natives with other countries, dispelling their former prejudices, and naturally leading them to that mode of grazing that appeared to them most beneficial. Besides, the same communication taught the lowest rank their own importance; and on that account, led them to raise their wages to such a degree that few could employ them, in Highland countries, for the improvement of the soil; and although it will be to no purpose to attempt to bring the natives back to their former system, yet it would be political wisdom to take advantage of this change of manners, and allure the small tenantry, by a sense of their own interests, to remain at home and not to emigrate to foreign countries.

It will readily occur that this can only be effected by supplying them easily with the means of a more improved husbandry and by establishing industries in the Highlands; and it is the influence that a navigable canal may, nay, must have, in promoting these particulars, that I mean now humbly to bring under your Lordship's view.

"Freeholder" went on to describe the route of the proposed canal; he declared that Nature seemed to point out the construction of the canal as a practicable measure, and he then detailed the various advantages likely to result therefrom.

In all these circumstances the building of the Canal was widely urged upon the Government as one of a series of public works likely to assure

such a degree of employment as would remove from the Highlands the immediate cause for emigration, and "at least preserve the remnant of a population on which, in times of need, such large and serviceable draughts were usually made for the support of our armies and navies."¹

The need, under these conditions, of providing the people with employment would, in fact, appear to have been regarded, at the time, as a still more powerful reason for taking definite action in the building of the canal than the provision of a better route in the special interests of the Navy and the mercantile marine. It was assumed, however, that, owing to the absence from the Highlands of important industrial and commercial interests, a work of such magnitude would have to be carried out, if at all, as a national undertaking.

TELFORD'S REPORT.

Thus it was that, in 1801, Telford was asked to report to the Lords Commissioners of his Majesty's Treasury on (1) the improvement of communications in Scotland by the provision of roads and bridges; (2) water supplies on the summit level of the proposed Caledonian Canal; (3) the best means of promoting fisheries on the east and west coasts; (4) the causes of emigration and the measures that should be taken for preventing it, and (5) the improvement of communications between Great Britain and the northern parts of Ireland.

Telford was engaged on this task from July, 1801, until towards the end of the same year. In his report, presented in 1802, he said concerning the emigration movement:—"About 3,000 persons went away in the course of last year, and if I am rightly informed, three times that number are preparing to leave in the course of the present year." He dealt, however, with the canal-construction scheme on its merits; and from this point of view he assumed, more especially, that such a canal would be a distinct advantage in time of war if not only coasting vessels but the largest class of Baltic or West Indian merchantmen on homeward or outward-bound passages to or from places on opposite sides of the Kingdom (and more especially to or from Ireland), and, also, ships belonging to the British Navy, could make use of a canal through the Great Caledonian Valley instead of being exposed to the danger of attack and loss along a line of coast then peculiarly favourable to the operations of an enemy. Telford was further encouraged to plan a canal of what, at that time, were regarded as exceptionally large proportions because of the apparently favourable conditions due to the existing chain of inland navigable lakes. He estimated for a canal which would have a depth of 20 ft. throughout and a width of 110 ft. at the surface and 50 ft. at the bottom. Twenty-nine locks would be needed, namely, fourteen ascending from the north-east to the summit level, and fifteen descending thence to the west. These locks, as originally planned by him, were to be 170 ft.

¹ Report, dated November 1st, 1837, of Mr. May, Superintendent of the Caledonian Canal, given in "Report of the Select Committee of the House of Commons on the Caledonian Canal," 1839.

long, 40 ft. broad and 20 ft. deep. The canal was to be capable of accommodating, not only merchantmen of the type already mentioned but 32-gun frigates, fully equipped and laden with stores. He estimated, in the first instance, that the undertaking would cost £350,000 to construct and that the work could be carried out in seven years.

When Telford prepared his report, he had before him a copy of the one which had already been presented by Watt. He had obtained it with a view to verifying his own observations, and he wrote in terms of much praise as to the accuracy and value of his predecessor's work. "Mr. Watt's views," he said, "were merely to ascertain how far a navigation of any sort was practicable, and, therefore, he fixed upon ten feet of water as an assured standard to enable him to make his estimate"; whereas Telford's estimate was for a canal of double that depth. So, he further said, "I lose the benefit of his particular calculations, and I am under the necessity of departing, in some instances, from his line of canal, especially at the entrances into the locks and tideways, in order to obtain a greater depth of water; but I have followed him wherever the circumstances would permit, and I cannot resist the introduction of his general description of the country through which the navigation is proposed to be made because, after having examined the whole with care, I find it to be so correct that I could only repeat the same descriptions and dwell upon the same points."

A Parliamentary Committee was appointed to consider Telford's report, and to this Committee there was submitted a letter which said:—

Such a canal would cut the island across and afford a more effectual way of escaping an enemy's cruisers than any hitherto devised, as ships from the West Indies and America would make the land to the northward, and, passing through the canal, arrive at London with little or no risk of capture, thereby avoiding the great danger of running the gauntlet in the British Channel. The canal would also afford great facility to the ships of Liverpool, &c., going to and from the Baltic, Hamburg, &c., and save them the dangerous navigation of the Pentland Firth or of going round the Orkney Islands.

THE UNDERTAKING AUTHORIZED.

An Act of Parliament which received the Royal assent on July 27th, 1803, authorized the undertaking, sanctioned a first grant by the Treasury of £20,000, and appointed Commissioners who were to take control of the canal for the Government. The Commissioners so appointed were the Speaker of the House of Commons, the Chancellor of the Exchequer and the Master of the Rolls for the time being, with nine others in case of whom provision was made for the appointment of their successors. The Commissioners were to hold their meetings "in London, or Westminster," and were to report annually to Parliament.

The nature of the hopes and anticipations which the scheme had inspired was well shown in some references to it by John Phillips in his "General History of Inland Navigation" (4th edition, 1803). The canal would, he declared, have a utility altogether "incalculable, and far

beyond anything of the kind in Great Britain or even Europe." It would ensure the passage to the Irish Channel in seven days, during the summer months, of the entire Baltic and North Sea trade which by the dangerous navigation via the Shetland and Orkney Islands could not be effected in stormy weather in less than three months, with the risk, as well, of loss of ships, cargoes and lives. In this way, too, there would be improved facilities for carrying on a trade then already of the value of £4,000,000 a year. Most important advantages would, also, be secured to our naval operations by opening up from east to west a ready, safe and rapid channel for naval squadrons.

On the passing of the Act of 1803, Telford, with whom William Jessop was now associated, proceeded with the final surveys, and, following thereon, the original estimate of £350,000 as the prospective cost of the work was raised to £474,000, exclusive of the value of land to be acquired and the amount of claims for compensation.

CONSTRUCTION DIFFICULTIES.

Construction was begun in 1804 at both ends of the proposed route, and difficulties of all kinds soon began to crowd upon Telford, who had been appointed engineer to the scheme. Those of a physical nature were, in themselves, sufficiently trying. Between Loch Eil and Loch Lochy, at the western end of the navigation, there is, in a distance of less than eight miles, a difference in level of 90 ft., and, in order that vessels could climb up the side of the hill at Banavie, between the two lochs, Telford built a flight of eight locks to which he gave the name of "Neptune's Staircase." It was, indeed, regarded at that time as a magnificent piece of work, and it was, in addition, one which involved an outlay of £50,000; but the "staircase" was to become a source of trouble not only on account of the locks but as "the neck of the bottle," governing the flow of the traffic, since any vessel that wanted to go up when another was coming down, or *vice versa*, had to wait until the whole of the eight locks were clear.

Then the ground passed over also gave much trouble. Large embankments were required at a number of points, and slips thereof became of frequent occurrence. The basin on Loch Eil had to be constructed amid rock, and here, also, much difficulty was experienced, while at Clachnaharry, on the Beaully Firth, immediately to the west of Inverness, it was necessary to have a sea-lock extending into the sea for a distance of over 450 yards.

Combined with these physical considerations was the fact that, down to this time, British engineers had had no experience in the construction of navigable waterways of so formidable a nature as that to be carried out in the Great Glen of Scotland. They knew all about barge canals and narrow canals; but in regard to ship canals, of the type now undertaken, their experience was still to be gained. So it was that Telford worked to a certain extent in the dark, and the costs of construction were increased in consequence.

The expenditure was further raised to abnormal proportions owing to

altered economic conditions due to the Napoleonic wars. Wages had to be increased substantially to meet the higher cost of living, thus anticipating the results of the Great War of 1914-1918. Labourers who were paid from 1s. 6d. to 1s. 8d. per day in 1803 got from 2s. 4d. to 2s. 6d. per day in 1814.

Materials of all kinds increased in cost between 50 and 100 per cent., as compared with the prices on which the estimates had been based. Such was the demand for oak, to supply the needs of the Navy under war-time conditions, that the cost of some qualities more than doubled and became, in effect, prohibitive so far as canal construction was concerned. Hence, although a few of the lock-gates were made of oak, the expedient was resorted to of constructing the remainder of cast-iron, sheathed with pine planking.

PARLIAMENTARY GRANTS.

Parliament met the outlay on the canal by annual votes, usually of £50,000 each. This (following on the initial grant of £20,000 in 1803), was the amount voted each year from 1804 to 1815, except on two occasions when the vote was for £51,000, and in 1811, when the grant was reduced to £40,000. In response to a special appeal by Telford, Parliament consented to give £75,000 in 1816; but in 1817 it gave no more than £25,000. The £50,000 was reverted to in 1816 and 1819, and was even increased to £60,000 in 1820. By this time the aggregate of the grants amounted to £905,000 as against Telford's first estimate of £350,000 and his 1804 estimate of £474,000. Unfortunately, also, there was still much left to be done.

The importance of the work from a national standpoint had been fully realized; but these annually-recurring grants, far in excess of what had originally been regarded as necessary, and, also, the delay in the opening of the canal, gave rise to much hostile criticism, if not to much denunciation, alike in the Press, among the public and in Parliament, Telford being made the scapegoat of adverse conditions for which, in the circumstances, it was unjust to hold him responsible.

Such criticism and denunciation were further encouraged by the financial depression following on the close of the war with France, and, also, by the wide-spread demand for economy in public expenditure, while there was then thought to be no longer the same need as there had been in a time of national crisis for giving State employment to Highlanders or others in order to check their emigration and to leave them still available for the Fighting Forces.

On the other hand the canal had some vigorous champions. Among the number was "Blackwood's Edinburgh Magazine," which, in an article on the "Caledonian Canal," published in July, 1820, said, among other things:—

Some of our readers are not a little surprised at the clamour lately revived in the House of Commons about the Caledonian Canal, and to our northern friends especially, the appellation of a "*Scotch job*" is particularly obnoxious, as applicable

to this work, both on account of its being one of the most magnificent and splendid of our national structures, and also from its having been undertaken for the general good and commercial enterprise of the United Kingdom. . . .

If anyone will take the trouble of going back to the debates of the House of Commons and inquire into the feelings of the country at the time when the question of the Caledonian Canal was first agitated, he will find that on all hands it proceeded from the noblest motives which can actuate the human mind. With what degree of propriety in political economy, we shall not venture to inquire; but at that period, every means were exerted to discourage emigration, by providing for the surplus population of the kingdom at large, and of the Highlands of Scotland in particular, where the more beneficial system of converting these districts into large *stock farms* had unavoidably made numerous families destitute. Emigration, as then conducted by designing persons, was not only ruinous to the emigrant, but the permission of it, under existing circumstances, would have been a stain upon the British name. With a view to put a stop to this traffic in human misery, and to ameliorate the condition of the native Highlander, the Legislature, with that degree of humanity which so eminently distinguishes the measures of the British Parliament, sought employment for the effective labour of the poorer classes, not of a temporary nature, but such as was calculated to be productive of benefit to the present and future circumstances of the agriculturist, the manufacturer and the mariner as the only safe and effectual means of relief; and after much consideration and advice, from all quarters of the United Kingdom, the Caledonian Canal was ultimately adopted as the measure best suited to those purposes. . . .

Prior to the period of the commencement of the Caledonian Canal, the inhabitants of the Highlands and Western Isles of Scotland, were in a state which may be described as maintaining a degree of apathy even beyond what has been too often ascribed to them. Having no incitement to labour, they were unaccustomed and unacquainted with it, and they consequently spent their days in the most supine indolence; without any stimulant to the habits of industry; if they looked to the past, it conveyed little that could satisfy a rational and intelligent mind; and there was no motive in the future to arouse them from a state of sloth. But let anyone now traverse these mountains and insulated districts to the northward of that chain of lakes forming the track of this Canal, and let him patiently investigate the present state of the inhabitants, and from observation and experience compare them with the past, and he will be astonished at the change which has been produced even within the last ten or twelve years upon the intelligence and manners of the inhabitants, and at the way in which they can now apply their minds and their hands to work. . . . The former state of the northern parts of Scotland is absolutely banished from Britain, and a spirit of emulation is now infused throughout the whole. To compare with the past, we must therefore now seek for it in the wilds of the Russian empire.

Replying to criticisms then being raised that these improvements in the condition of the people might have been due in part to other causes than the construction of the canal, that English, Welsh and Irish labour was also employed, and that, so far as the discouragement of emigration was concerned, the money earned on the canal provided many of the Highlanders with the means by which they could still resort to the emigration on which they were bent, the article continued:—

No one will be hardy enough to affirm that the expenditure of a very large proportion of £800,000 in *day-labour*, has not effected the most powerful changes on this country, and on the customs and manners of its people. . . . It was none of the least of the benefits of this work that it collected artizans of every description from England and Ireland, who taught the people of the Highlands of Scot-

land how to handle the spade, the mattock, and all the implements of the artificer. . . .

Even if we admit, that with part of this money many hundreds of the natives have been enabled to emigrate to our American settlements with comfort and advantage to themselves, though this *may not be* what was originally sought after or intended,¹ yet we even venture to claim this also as one of the advantages attending the execution of this work, in which we are borne out by the present practice of the country; for, in point of fact, large sums are now actually paid from the treasury to encourage emigration to certain of our colonial establishments. Now, how much better is it for the individuals and for the country, that these people should acquire the means of following their inclinations with the savings of their own industry.

As for the contentions which had been raised that the Caledonian Canal was not really wanted and was not likely to pay its way, the writer of the article further said:—

There may indeed be no immediate use for a canal of a large capacity in this situation, but those acquainted with the history of the Canal, long since executed, between the friths of Forth and Clyde, technically termed the "Great Canal," may recollect that the dimensions were at first considered to be by much too large, and that it was also treated as a work ruinous to the adventurers; and that the large sums advanced for its completion by the government were to be lost for ever. . . . The Forth and Clyde is found to be much too small in practice; but nevertheless, the money advanced by government has long since been repaid.

It was, therefore, in our humble opinion, the soundest policy for the legislature, in the original formation of this great national work, to do it, in the first instance, upon a scale that would admit of the largest class of merchant vessels, and even of the smaller of his Majesty's ships of war; or, in other words, to avoid the fatal error of the proprietors of the Forth and Clyde Canal. . . . We have no hesitation in stating it as our opinion, that the Caledonian Canal is a most important link in the chain of national prosperity.

The immediate outcome of the controversy thus raised was the suspension in 1821 of any further Parliamentary grants for the Caledonian Canal, while in 1822 Mr. Hume recommended in the House of Commons that the work—which had then been in progress for eighteen years instead of only the seven within which it was to have been completed—should be abandoned in order that further outlay upon it might be saved. As an alternative to so extreme a measure, Parliament decided that the canal should be opened for use forthwith.

THE CANAL OPENED.

An account of the formal opening of the canal on October 24th, 1822, reproduced from the *Inverness Courier* of October 31st, 1822, is given in an Appendix. It may here suffice to say, in connection with this event, that at the dinner which formed part of the festivities Mr. Charles Grant, a director of the East India Company, one of the most zealous of the Caledonian Canal Commissioners and the host on the occasion, expressed

¹ What the Highlanders wanted was, of course, not only the means of earning a livelihood, to save them from destitution, but the *land* of which they had been deprived; and it was to secure land overseas, when they could no longer get it at home, that they were still bent on emigration.

his belief, in proposing the toast, "Prosperity to the Caledonian Canal," that the undertaking was "one of the most stupendous" of that nature which Europe had seen—

Not so much for its length, though that was very considerable . . . but for its depth, which was to be, throughout, in the artificial part, 20 ft., and in the natural part vastly more. The design of it was great. It was not only to open a direct inland communication by water between the eastern and western coasts of Great Britain but to open a new line of intercourse between the Western Ocean and the North Sea, so as to avoid the stormy and circuitous navigation of the Pentland Firth and Cape Wrath, thus enabling ships, British and Irish, in the Baltic trade to pass at once through a safe inland channel to the northern countries of Europe. It was also contemplated that, in times of emergency, frigates of war might very expeditiously pass by the same channel direct from the west of Britain to the Northern Sea. In a national view this design was evidently of high importance. . . . At present the great work in question opened the communication from the east to the west with, generally, 12 ft. depth of water, which was sufficient for the coasting trade and such vessels as were usually employed in it. The original design being so far completed, the opening of the canal ought in no case to be delayed; but there was certainly the further reason for turning it to the best account in its present state, that the pressure on the public finances, during some late years, had increased the difficulty of making further advances for this work, which, no doubt, had cost far more than the sum originally estimated.

In an account of the opening of the canal published in the Supplement to Vol. XCII, Part II (1822), of the "Gentleman's Magazine," it was said:—"This work will immortalize the genius of the times, the liberal policy of the Nation and the reigns of George III and IV." Neptune's Staircase was thus described:—"This majestic chain of locks sits altogether about sixty feet perpendicular, and cost about 50,000*l.* They present the greatest mass of masonry to be found in the world, as applicable to the purposes of a canal."

AN INCOMPLETE WORK.

The whole work was, at this time, avowedly incomplete. The depth of water in the cuttings was not more than 13 ft.—and, as just shown, more generally only 12 ft.—in place of the 20 ft. originally allowed for, and the construction was so imperfect that the canal, and more especially the masonry connected with the locks, soon began to show signs of decay. The dimensions of the locks had been kept to 160 ft. in length, 38 ft. in breadth and 15 ft. in depth; but even then the shallowness of the intervening cuttings prevented the use of the canal by vessels equal to the full capacity of the locks, the utility and the earning power of the canal in regard to the most desirable and remunerative branches of the traffic it was hoped to secure being reduced proportionately.

PHYSICAL DISADVANTAGES.

In addition to these constructional shortcomings, there were the physical disadvantages which, though pointed out by Edward Burt almost a century earlier, were not, perhaps, sufficiently taken into account until

experience began to show how abundantly warranted his observations and forecast had been.

The Caledonian Valley is formed of two parallel ranges of lofty mountains the steep sides of which are rarely broken by collateral valleys, while the prevalent winds in this part of Scotland are subject to but little variation, being generally easterly for three or four months during the latter end of spring and the beginning of summer, and westerly during the remainder of the year. For these winds the Great Glen, owing to the nature of its formation, acts as a huge funnel through which the winds rush in a direction either favourable to vessels passing through the canal or dead against them. The sea-lochs at each end of the canal are subject to like disadvantages.

To-day, in an age of steamships, these conditions are not of much account ; but sailing-vessels were alone known when the Caledonian Canal was projected, and they were still mainly in vogue when the canal was opened. They had, also, the greater difficulty in passing through the canal because, owing to the comparative narrowness of the lochs—the shores of which were so rugged and steep that they did not permit of towing paths being provided—it was impossible to overcome adverse winds by means of tacking, while the considerable depth of the lochs, in parts, was unfavourable for safe anchorage. So there were occasions when the sailing-ships—and especially those of any size—had no alternative but to wait either for a dead calm or for a change of wind to the opposite direction. The delays thus caused were such that, instead of accomplishing the passage of sixty miles in three or four days, as they should have done, vessels were often as many weeks in getting through. A month, it has been officially stated, was not unusual, and cases in which five weeks had been taken were not unknown. In this way one of the main purposes of the canal, in avoiding the delays that might arise in making the passage via Cape Wrath and Pentland Firth, was, to a certain extent, defeated.

Although, again, steamships were not liable to the same delays when passing through the canal, they were, also, better able to brave the risks of the all-sea route. This they generally preferred to do in order to save the canal dues. In proportion, therefore, as the number of steam-vessels increased, the patronage of the canal declined more and more.

In this combination of circumstances and conditions, the revenue became insignificant at a time when all the money that could be got was wanted, not only for keeping the canal in tolerable repair, but for completing it according to the original plans. In point of fact the constantly deficient income failed even to cover current expenses. Parliament had made further grants in 1822, 1823 and 1824 ; but on the last of these occasions it was announced that no more grants were to be expected. The patience of politicians was exhausted, and the canal was thenceforward to be self-supporting.

Concerning alike the early patronage of the canal, the incompleteness of the waterway and, apparently, the purposes to which the last of the

grants here in question was to be devoted, the "Gentleman's Magazine" for December, 1824, said :—

The Caledonian Canal has so far succeeded that in August last 121 vessels navigated some parts of it : several with wood, passing from Hull to Liverpool ; others to and from Dumfries, Belfast, Londonderry, or Liverpool, Newcastle, &c., with lime, slates, freestone, salt, herrings, staves, deals, &c. Three steam-packets pass through from Inverness to Glasgow : the works are, however, not yet completed and some part of the line is to be laid dry next summer, and deepened for 18 feet water, when the largest merchant vessels will pass from sea to sea through this magnificent canal.

By May 1st, 1827, the total expenditure on the canal had amounted to over £973,000, and the revenue was still so inadequate that in 1830 an additional grant of £4,886 was made by Parliament as a contribution towards clearing off an accumulation of liabilities. This raised to £952,000 the sum total of the votes down to that year. Apart from the liabilities in question, there remained the still unascertained claims to compensation in respect to land taken over from various owners.

FRANCE AND THE CALEDONIAN CANAL.

In the early days of the nineteenth century the numerous canal undertakings in Great Britain were attracting an exceptional degree of attention in France from the point of view, more especially, of the lessons that might be learned from them in the interests of an expansion of inland navigation in that country. Certain exaggerated or erroneous reports as to what was being done on this side of the Channel had been put into circulation, and this fact was regarded by those in authority in France as a further reason for obtaining definite and, as far as possible, technical information as to what their neighbours were really doing in respect alike to canals and to public works in general.

Under these circumstances and conditions it was that the Directeur Général des Ponts et Chaussées instructed Monsieur J. Dutens, then a Divisional Inspector of that corps, to visit this country and prepare a series of "Mémoires sur les Travaux Publics de l'Angleterre." The results of his inquiries were published in volume form in 1819 under the said title, the undertakings which formed the special objects of the inquirer's investigations being canals, roads, bridges and sea-ports. The greatest degree of attention, however, seems to have been paid to canals ; and concerning these the writer of the "Mémoires" explains that he had sought to deduce from what he had seen in England in regard to inland navigation the principles which might usefully be adopted in France.

Dutens passed under review practically the whole of the canals which had been constructed in England at the time he wrote ; but in regard to the Caledonian Canal he said :—

Not having seen the Caledonian Canal, I had in no way any intention to speak of it when I began these Mémoires ; but, having procured the first seven reports, for the years from 1804 to 1811, presented to Parliament by the Caledonian Canal Commissioners, which reports are accompanied by some excellent maps, and

finding, also, that the "Encyclopædia Britannica" contained a detailed account of this great work, I have thought it would be of interest if I presented here a translation of this article, thus affording some idea of an important enterprise which circumstances have prevented me from visiting.

Then followed the said translation of the article as contributed to the "Encyclopædia Britannica," by Robert Stevenson, and written by him, apparently, in 1815 or 1816, giving an account of the works so far as they had been completed down to that date.

Ten years later—that is to say, in 1829—Dutens published a "Histoire de la Navigation Intérieure de la France, avec un exposé des canaux à entreprendre pour en compléter le système." We may fairly assume that, in his preparation of this work, Dutens had found his experiences in England of some service to him.

One learns, in the next place, that a visit to the Caledonian Canal was paid in 1817 by Baron Charles Dupin, a distinguished authority in his day on inland navigation and other subjects. Dupin had undertaken a mission somewhat similar to that of Dutens, and the results of his inquiries were published in Paris in 1818, as "Mémoires sur la Marine et les Ponts et Chaussées de France et d'Angleterre, contenant deux relations de Voyages faits dans les ports d'Angleterre, d'Ecosse et d'Irlande dans les années 1816, 1817 et 1818."

An English translation was published in London, in 1819, under the title of "Narratives of two Excursions to the Ports of England, Scotland and Ireland in 1816, 1817 and 1818; together with a description of . . . the Caledonian Canal. Translated from the French." While, however, Dupin certainly did get as far as the Caledonian Canal, the description he gives of it—in addition to an account of English canals in general—is no more than a paraphrase of the "Encyclopædia Britannica" article, supplemented by details concerning incidents in the history of the Highlands and other matters which do not add any material facts to the story in regard to the canal itself; though in reproducing his narratives in "Voyages dans la Grande-Bretagne, entrepris relativement aux services publics de la Guerre, de la Marine et des Ponts et Chaussées depuis 1816," published in Paris in 1824, he does add a paragraph mentioning that the canal had been officially opened in October, 1822.

Thus far, therefore, no original account of the Caledonian Canal had been laid before the French public; but in 1828 there was published in Paris a special study of the undertaking, by Stéphane Flachet, under the title of "Histoire des travaux et de l'aménagement des eaux du canal Calédonien." This exhaustive work deserves to rank as probably the most complete study of the Caledonian Canal, from an engineering point of view, that has ever yet been produced, and it must have been especially welcome to those interested in the subject in France.

The expression "l'aménagement des eaux," here made use of, might, perhaps, best be rendered in English by "the regulation of the waters"—that is to say, the impounding and storage of supply water, the disposal of flood water, and the maintenance of artificial banks, of altered river

courses, of the levels of the various lakes, and, also, of the navigable depth in the approach channels. The experience of the Caledonian Canal engineers on these various matters was still incomplete when Stevenson's article was written for the "Encyclopædia Britannica," inasmuch as the construction of the artificial channels had not then been sufficiently advanced to allow of their being filled with water. In addition to this, reference to the early reports of the Commissioners shows that much concern was being felt on account of the problem presented by the prevalent floods. Five mountain streams had been carried under the canal in culverts, but there were still some rivulets ("burns") which discharged into the canal, causing fluctuations of level in the reaches. Some importance, also, was evidently attached at this period to the provision and the construction of regulating sluices. In Edward Cresy's "Encyclopædia of Civil Engineering" (London: 1847), there is given a description, accompanied by an illustration, of the sluice at Strone, (between Corpach and Loch Lochy)—a work, novel when it was constructed, which still regulates the level of the Banavie reach, although not automatic like the one at Ardrishaig, on the Crinan Canal.

Flachat explains in his book that, at the time he wrote, navigation on the rivers leading to the three principal ports in France—Bordeaux, Nantes and Rouen—was either dangerous or impracticable for sea-going vessels; and, inasmuch as great interests were concerned in the questions arising in connection therewith, it was regarded as essential that exact information should be acquired as to the way in which the works in connection with the Caledonian Canal—"the only important canal at present open to sea-going vessels"—were being carried out. Such information, more especially in regard to the regulation of the waters, including therein the prevention of leakages in the canal banks, might be a possible means of facilitating the construction of ship canals ("canaux maritimes") in France, and, inasmuch as Stevenson's article did not, for the reason stated, throw light on these subjects, it had been determined that a special inquiry should be made into them from the point of view of French conditions and requirements.

Flachat's account of the canal, based on his own investigations supplemented by the reports of Telford and Jessop together with the reports, so far as they had then been issued, of the Caledonian Canal Commissioners, made 92 quarto pages, and it was accompanied by a separate volume of plans, maps and sections drawn up "on the spot" with the assistance of the resident engineers. He had been particularly impressed by a trip he made on the canal by steamer, first from Muirtown to Neptune's Staircase, and afterwards from Fort Augustus to Muirtown. Steam navigation had then, he says, been in operation on the canal for seven or eight years, and he describes the steamboat on which he made his journeys as one having engines of 26 h.p., a breadth of 25 ft., including the paddle wheels, with a draught of $6\frac{1}{2}$ ft., and equal to a speed of between six and seven miles an hour.

Comparing this Scottish canal with the ship canals then being pro-

jected in France, Flachet said that the latter would be constructed in much easier situations and on ground far more level ; that there would be no need for great embankments akin to those that had raised to so high a figure the cost of constructing the Caledonian Canal ; that the number of locks necessary would be infinitely fewer, and that whereas, in the case of the Caledonian, the carrying out of the work had been attended by great difficulties and expense in respect to labour, situation and communications, the maritime canals proposed in France would be built with all the advantages which machinery and industry could offer in the way of resources and economy. Bearing all these things in mind, there could, he said, be no doubt that the French undertakings would cost at least one-third less than had been spent on the Caledonian Canal.

The fruits of Flachet's visit to Scotland were, so far as France was concerned, seen in 1829, when there was published in Paris a work, in four volumes, entitled " Du canal maritime de Rouen à Paris," containing studies, reports and estimates dealing with this project from every possible point of view, the whole being issued under the editorship of Stéphane Flachet, " Directeur des Études."

COMPLETION OR ABANDONMENT ?

From 1830 onward, the efficiency of the Caledonian Canal was a constantly diminishing quantity.

Falls of earth and rock from the adjoining heights had reduced the available depths of water in the cuttings ; but more serious still were the accidents and mishaps traceable to the premature opening in 1822, in deference to the impatience alike of Parliament and of the public. A series of such accidents, involving a heavy drain upon the scanty resources of the Commissioners, culminated (1838) in the collapse of the side wall in the lowest lock at Fort Augustus, while the general conditions of a work upon which, by that time, £1,023,000 had been expended (apart from further liabilities incurred to the extent of £39,000), was such that the Commissioners instructed Mr. James Walker, then President of the Institution of Civil Engineers, to carry out a thorough examination and report as to what would be necessary to complete the undertaking, in order that the Government might decide whether the canal should be abandoned and the entire expenditure sacrificed, or whether it should be rendered capable of carrying the traffic for which it had been originally designed.

In the report he presented as the result of an exhaustive inquiry, Mr. Walker estimated that at this time the traffic passing through the canal was probably not $2\frac{1}{2}$ per cent. of that which made the voyage by way of Pentland Firth, in spite of the dangers of the latter route. The only possible remedies for these conditions were, he thought, to be found in completing the canal, increasing its depth to at least 17 ft., putting the whole of the works into an efficient condition, and stationing steam-tugs on the canal in order that sailing-vessels could be taken through independently of the winds. Many of the locks, he found, were in a defective

condition, while Loch Lochy had become a source of the gravest danger to the district. The waters of the lake, which had a surface area of 6,000 acres and were dammed up many feet above their natural base, were held back by only a single pair of gates from devastating the country and the villages on a lower level.

The cost of the repairs and improvements he recommended was put by Mr. Walker at £200,000. He was of opinion that, if they were carried out and the navigation rendered thoroughly serviceable, the canal would "prove a most useful public work for the general coasting trade of the Kingdom and for the trade between the Baltic and the west coast, including the Clyde, Liverpool, and Ireland, and for vessels bound to America from the eastern ports of the Kingdom." In case of war and of the English Channel being infested by steam privateers, the canal would "afford a passage of comparative safety for the trade between the West Indies, or America, and the east coast of Great Britain." The canal had "never yet had a chance." As a facility for trade, and as an alternative to the long passage through Pentland Firth and round Cape Wrath, it had hitherto been a failure. All its "bearings and prospects" had, also, been altered by the introduction of steamships.

This report by Mr. Walker and the annual reports of the Canal Commissioners, in which a good deal to the same effect had already been said, were referred to a Select Committee of the House of Commons appointed in 1839 to consider what steps it was advisable to take with respect to the state of the canal. In describing the conditions as they found them, the Select Committee reported that, owing to the imperfect original construction of many portions of the canal, the leakage through the banks was so great as to render it impossible to maintain uniformly such a depth of water as would render it at all times navigable for vessels of any moderate size. "The whole works," they declared, "appear to be in a dilapidated and insecure state, and their condition is daily becoming more alarming."

As regarded the abandonment of the canal—a course then still being recommended from time to time—the Select Committee said that, if this policy should be adopted, it would still be necessary to maintain banks and locks to prevent the flooding of the neighbouring district—the more so as it was doubtful if Loch Lochy could be restored to its original level. If the canal were abandoned there would, apart from other considerations, have to be almost as large an establishment kept on, to ensure the safety of the works—and this without any prospect of a return on the expenditure—as if the navigation were kept open. In all the circumstances, the Select Committee were of opinion that the idea of abandonment could not be entertained, and they recommended that effect should be given to Mr. Walker's proposals, a sum not exceeding £200,000 being placed by Parliament at the disposal of the Government for that purpose.

The case in favour of completion was further strengthened, at this time, by evidence adduced as to the delays to which sailing-ships were subject in making the passage round the north coast of Scotland. The

navigation of Pentland Firth, with its strong tides, heavy seas, high winds and frequent storms, was spoken of by one captain in the mercantile marine as "just as bad as going round Cape Horn." As for the actual detentions on account of contrary winds, there were almost innumerable instances of sailing-ships having to stay at the Orkneys or elsewhere, *en route*, for periods of one, two or even three months before they could resume their voyage. One Glasgow shipowner spoke of five vessels which left St. Petersburg in October, were held up in Pentland Firth, and did not get to Glasgow until the following March. Two ships left Newcastle on successive days, one for Bombay and the other for Liverpool, both to go by the north-about route. The wind continued favourable until the first had passed through, and then it suddenly "chopped round" and continued unfavourable so long that the one vessel reached Bombay before the other could get to Liverpool. The passage between Aberdeen and Liverpool had been done in six days; but specific instances were given of sailing-ships taking a month, six weeks, two months, and even three months on the same voyage. Vessels from Aberdeen to the West Indies were, on different occasions, three weeks, six weeks and thirteen weeks before they finally lost sight of Ireland. It was further said there were occasions when over 200 sailing-ships were wind-bound on the east and north coasts of Scotland at an enormous current expense, apart from the higher rates of insurance.

TRANSFER TO PRIVATE ENTERPRISE PROPOSED.

Notwithstanding all such testimony as this, there was still a good deal of hostility in Parliament and elsewhere to the idea of more public money being spent on what many persons regarded as an undertaking of very doubtful practical value; and, for a time, the hopes alike of the Government and of Parliament were directed to the possibility of getting some private company to take over the canal and operate it as a commercial undertaking. "In 1840," the Commissioners said in their report for 1860, "the principle of a lease was adopted by Parliament. It was then represented that, although every effort of the Commissioners had hitherto failed to make the Caledonian Canal a profitable undertaking, private enterprise might possibly succeed in making it productive as a commercial speculation." An Act was accordingly passed by which the Treasury were empowered to lease the canal to a joint-stock company, and negotiations entered upon with this object in view went so far that another Select Committee was appointed in the same year (1840) to consider afresh "the present state of the canal" as well as certain correspondence that had passed in regard to the proposed transfer from Government control to private enterprise. The Select Committee agreed that such transfer was desirable and would be of advantage under proper regulations and conditions. As for the state of the canal, they found that, since the Select Committee of 1839 had concluded its labours, more of the walls had given way, rendering navigation impossible in places. The whole canal had, apparently, become still more dilapidated, and still more

dangerous to the surrounding district, than ever. The report further said :—

The Committee feel it to be their duty to call the consideration of the House to the very serious evil that is incurred by permitting the works to remain longer in their present insecure state, and your Committee must express a strong opinion that, in the event of the proposed arrangement for leasing the canal not being carried into effect in the course of the present year, the necessary repairs in accordance with the report of the Select Committee of last Session, ought to be completed under the joint direction and authority of the Government and of the Commissioners of the Canal, Parliament placing the necessary funds at the disposal of the Treasury.

GOVERNMENT INDECISION.

For some reason or other, the negotiations for leasing the canal to a company fell through ; but the Government still hesitated to incur the heavy liabilities which the carrying out of the works recommended would have involved. So the Lords Commissioners of the Treasury determined first to take the advice of an experienced naval officer on the expediency of completing the canal, and the services of Captain Sir William Edward Parry, R.N., the Arctic explorer, and head of one of the Admiralty Departments, were engaged for this purpose. His instructions were “ to ascertain, by personal communication with the principal shipowners and merchants in the ports of Liverpool, Glasgow, Aberdeen, Dundee, Leith, Newcastle and Hull, to what extent it was probable that vessels sailing from those ports would make use of the canal if the projected improvements were all executed.” On these points he said in his report, presented in March, 1842, that—

If the Caledonian Canal were made efficient, it would very shortly be used by almost all those coasting vessels which now pursue a northern route in trading between the eastern and western coasts of England and Scotland (especially Hull and Liverpool, and all ports to the north), or between the former and the ports of Ireland ; by nearly the whole of the vessels, whether British or foreign, coming from the Baltic, especially late in the season, and bound to ports on the western coast of this island, or to the ports of Ireland ; and not unfrequently by vessels trading between our north-eastern ports and North America, or the West Indies ; that in case of war with any nation fitting out fast-sailing vessels, or steam-vessels, as privateers, the passage of the Caledonian Canal for merchant vessels would almost wholly supersede that by the Pentland Firth ; since a single efficient man-of-war, of no great force, would suffice to give protection to each approach of the canal by sea.

In regard to the condition of the canal, Sir William Parry fully supported what Mr. Walker and the Select Committees of 1839 and 1840 had recommended. He himself came to the conclusion that the canal, owing to its hitherto imperfect state—including the small, variable and uncertain depth of water and the entire absence of the requisite facilities either for getting through the canal itself or for navigating the approaches to it from the sea—had never yet had a fair trial of its capabilities. He was of opinion that nothing short of complete efficiency would answer, while the dangerous state of some of the works threatened incalculable

damage to property and perhaps destruction of life, as well. He further estimated that the cost of abandoning this "splendid national undertaking" would be at least one-third of the cost of completing it.

Even now (March, 1842) the Government could not make up their minds. They referred Sir William Parry's report and the reports of the Select Committees of 1839 and 1840 to still another Select Committee. This Committee, in turn, reported, in the following May, that the cost of abandoning the canal would be £40,000, or, including extinction of the debt on the undertaking, £91,000, whereas the carrying out of all the necessary repairs, the improvement of the navigation along the whole line of the canal and the provision of a fleet of steam-tugs could, they thought, be done for £150,000. They therefore strongly supported the views of the earlier Committees and of Sir William Parry.

Parliament had voted £25,000 in 1841 to meet advances which, owing to the deficiency in revenue, the Commissioners had been obliged to secure from the Bank of Scotland for urgent repairs, and this was followed, in 1842, by a vote of £27,000 to clear off the residue of the debt to the Bank of Scotland and to meet the compensation claims of land proprietors along the line of route. These votes were made without reference to the policy of completion; but the Government did, nevertheless, now decide upon adopting the course which had been so repeatedly urged upon them.

PARLIAMENTARY PROTESTS.

On July 25th, 1842, Sir G. Clerk, dealing in the Commons with questions of Supply, said that over £1,000,000 had already been spent on the Caledonian Canal; but there was a fair prospect that, if the works were put into a perfect state, the canal would be used. It could be completed in three years at a cost of £150,000, and he proposed to take £50,000 a year for that period.

Thereupon the storm of opposition broke out afresh. Mr. Williams described the canal as "a scandalous job," and Mr. Hume repeated the recommendation he had made twenty years previously—that the works should be abandoned. To all this the Premier, Sir Robert Peel, replied that he had himself formerly been opposed to spending public money on an undertaking which he did not hesitate to say was a most absurd speculation. Had it not been for the application of steam navigation, the canal would have been worth absolutely nothing. But the question was whether it would not be better to expend £150,000 with the hope of a profitable return than £40,000 for the purpose of destroying the works. If parties could not be found who were prepared to carry through the whole of the repairs and improvements for the sum mentioned, no part of the money should be laid out. The House then agreed to the vote.

The controversy was resumed, however, when the matter came before the Commons again in August, 1843. By that time the Government had

found that £203,000 instead of £150,000 would have to be spent on the new works, and they asked for a vote on this basis. Mr. Williams made further indignant protests. The Government, he declared, "ought to abandon so worthless an undertaking." Mr. Hume was still of the same opinion as before. The canal would be "utterly valueless," so far as the commerce of the country was concerned. Better far would it be, he protested, to abandon it, and sacrifice £40,000 or £50,000 in doing so, than incur a loss to the public of an additional £150,000.

On a vote of the House being taken, the proposals of the Government were agreed to, and, a satisfactory contract for the whole of the work having been made, the canal was duly completed and re-opened for traffic on May 1st, 1847.

By this time the total cost of reconstruction had amounted to £228,000—or £28,000 in excess of Mr. Walker's estimate and £78,000 in excess of the sum which the Government of 1842 thought would suffice. It included, however, £5,000 granted for "extra works of utility" designed to alleviate the distress prevalent in the Highland districts in 1846-7, the semi-eleemosynary motives which had influenced the Government at the outset thus coming once more into operation.

When re-opened, the canal had 17 ft. of water in the artificial channels, and, inasmuch as no further reconstruction has since been carried out, the depth of 20 ft. originally projected by Telford has never been attained. A fleet of four steam-tugs enabled sailing-vessels to overcome the disadvantages of adverse winds¹ and assured them a passage through the canal from sea to sea in from twenty-four to thirty-six hours; but, although the introduction of these steam-tugs increased the usefulness of the canal and was a contributory cause to a three-fold expansion of the tonnage of vessels dealt with, they were far from being a financial success. In their report for 1860, the Commissioners said that the cost of maintaining the steam-tugs had generally been double their earnings. The Commissioners had "vainly endeavoured to encourage private parties to undertake this service."

Following on the re-opening of the canal, there was passed, in 1848, an Act which increased the number of Commissioners, converted them into a corporate body under the designation of "The Commissioners of the Caledonian Canal," and, as will be shown in the following chapter, vesting in them the property and control, not alone of that waterway, but, also, of the Crinan Canal.

The new Commissioners were to consist of the Speaker of the House of Commons, the Chancellor of the Exchequer, the "Lord High Admiral," the "Vice-President of the Board of Trade," the Lord Advocate, and the Member for the County of Argyll for the time being, together with various local gentlemen, power being further given to her Majesty to appoint their successors or other Commissioners, not exceeding eight in number. The meetings of the Commissioners were held in the House of Commons.

¹ A steam-tug is still employed on the canal for this purpose.

DESCRIPTION OF THE CANAL : EAST TO WEST.¹

The canal is entered from the sea, in Beaully Firth, by the Clachnaharry Sea Lock—a single lock available, according to tide, for at least eight hours out of every twelve. A swing bridge carries the Highland Railway across the canal at this point. The lock connects with the Clachnaharry Basin. A single lock gives access therefrom to the Muirtown Basin, the area of which is about twenty acres, so that from eighty to ninety fishing steamers can be moored there without blocking the fairway. At the other end of the basin there is a swing bridge (carrying the public road across the canal) and the Muirtown locks—a flight of four connected locks giving access to Muirtown Reach. This reach, which has a level of about 49 ft., is five miles in length. It is crossed by a swing road bridge at Bught, and at the other end is Dochgarroch lock, which gives access to Loch Dochfour, a continuation of Loch Ness.

Loch Ness is the largest of the three natural lakes on the canal. It is about twenty-four miles long, from one mile to two and a half miles broad, and is very deep—attaining at one point a depth of 129 fathoms. The average level is about 51 ft. Each side of the loch is bordered by precipitous mountains divided, in places, by deep gullies. Along these flow powerful streams which assume at times the form of raging torrents, while the effect of the mountains along the glen in forming the “funnel” spoken of on p. 18 is here especially noticeable, the winds being, as a rule, easterly from March to the end of September and westerly from October to the end of February. Of the seven piers on Loch Ness, the one at Foyers is used principally in connection with the British Aluminium Company's works there. This is the only place served by the canal where, at present, water power is used to any extent. At the west end of Loch Ness is Fort Augustus, and here there is a swing bridge carrying the public road across the canal, a flight of five connected locks, and, passing above the locks, a swing railway bridge.

Above the Fort Augustus locks is the Fort Augustus Reach, at a level of about 89 ft. It extends a distance of two and a half miles to Kytra, where a single lock leads to the Cullochry Reach, two miles long, and situate at an elevation of 97 ft. It terminates in a single lock giving access to a channel connecting with Loch Oich.

Here one attains to the summit of the canal. Loch Oich stands at a level of about 106 ft. ; it is four miles long, and its main supply of water comes from Loch Quoich, Loch Garry and the Aberchaldler Burn. The summit water supply is, however, irregular, varying from occasional insufficiency to heavy floods. The bottom of the loch is, also, very irregular, shallows being found in some places and depths of water to 76 fathoms in others.

At the west end of Loch Oich is the Laggan Reach, about a mile and a half in length. It is crossed by a swing road bridge and ends at Laggan

¹ See map facing p. 42.

Locks—two connected locks which give access to Loch Lochy. Over one of the locks there is another swing road bridge.

Loch Lochy is about ten miles long, one mile broad, and is at an elevation of about 95 ft.¹ Its considerable drainage area includes Loch Arkaig, which, situated some 48 ft. higher, flows into it. While in parts the depth of water is 60 or 70 fathoms, elsewhere it was found so inadequate that the loch had to be deepened by dredging.

Approached by a sheltered channel from the west end of Loch Lochy are the Gairloch locks, through which one passes to the Banavie Reach, six miles long and at a level of 86 ft. Between the two locks at Gairloch there is a swing bridge carrying the public road across the canal, and a mile further on there is another swing bridge for an accommodation road at Moy. Four culverts below the canal provide for the passage of streams.

Banavie Reach leads to the Banavie Locks, otherwise known as "Neptune's Staircase." Here there are eight connected locks, giving a total fall of 64 ft. One of them is crossed by a swing road bridge. Between these locks and Corpach is the Corpach Reach, a mile long, with a level of 22½ ft., and crossed by the West Highland Railway swing bridge at Banavie.

At Corpach two connected locks lead into the Corpach Basin. Access therefrom to the sea is obtained by the Corpach sea lock which, like that at Clachnaharry, is available for only about eight hours out of every twelve.

The total length of the canal is a little more than sixty miles. Its twenty-nine locks have forty-two pairs of lock gates, and the dimensions of the largest vessel that can pass through are—160 ft. length, 38 ft. beam and 14 ft. draught. The locks are not only too small in themselves for much of the traffic that might be available but they are unduly short in proportion to their width.

AN UNPROGRESSIVE WATERWAY.

Since 1847 the canal has remained in practically the same condition as it was then, save for indispensable repairs and renovations. Parliament made a grant of £10,000 in 1849, on account of damage done by floods, and various grants to a total of £25,000 were made between 1887 and 1893 for the renewal of lock gates. Apart from such works as these, nothing has been done to adapt the canal to modern requirements. The sailing-vessels for which it was originally designed have been largely superseded by steamships, and the great majority of steamships to-day are of a size beyond the capacity of the canal. Instead, however, of the canal being enlarged to meet these needs, a reduction to about 14 ft. was caused in the depth of the channel owing to further accumulations of rocks and debris

¹ The elevation of Loch Lochy is a varying quantity according to water-supply conditions. It figures on the Ordnance Survey maps as 93 ft.; but sometimes it is lower than this, and sometimes a good deal higher, so that 93 ft. is, probably, rather below the average water level. For the purposes of the present work the average has been taken as 95 ft. above Ordnance datum.

from the hillsides and, also, to the throwing of large quantities of sand and other material into portions of the reaches to stop leaks attributable to the fact that the banks had not been properly puddled. On several occasions, also, navigation has had to be suspended on account of inadequate water supply. This was especially the case in 1889 when, for a period of ten weeks, there was a depth of only about 4 ft. of water above the shoals in Loch Oich.

DECLINED AS A FREE GIFT.

Financially, the outlook became so unsatisfactory that in 1860 further attempts were made to induce private enterprise to relieve the State of a troublesome burden. No application had then been made to Parliament for several years for further grants in aid of the canal. The revenue had been insufficient to meet the expenditure, but the Commissioners were able to provide for the deficiency out of a reserve fund formed from the balance of previous grants. This fund, however, was exhausted at the end of 1859, and in the following year the Commissioners—notwithstanding the fact that, as they stated in their report for 1860, “the financial condition of the Caledonian Canal had hitherto been so depressed as to discourage capitalists from seeking any connection with that undertaking”—again invited tenders for a lease. They failed to receive any offer which they could recommend to the favourable notice of the Treasury. Thereupon the Government introduced into an Act passed in July, 1860, and designed to amend earlier provisions and powers in respect to the Caledonian and Crinan Canals, a clause which provided that—

It shall be lawful for the Commissioners, with the consent of the Treasury, to grant or lease the canals, or either of them, for a period not exceeding ninety-nine years, with or without any annual return or rent therefor, to any person or company under such conditions as they think necessary and proper.

This looked like offering the canals as a free gift ; yet private enterprise was, apparently, unwilling to accept them—and the responsibilities they involved—even on these terms.

Reviewing the situation thus brought about, the Commissioners said in their report for 1860 :—

It was the policy of a past generation to construct and maintain such a work at the public expense. For that policy and for its failure the Commissioners are not responsible. That private capitalists, in an age of speculative enterprise, have been unwilling to accept, even without a rent, the lease of a great inland navigation—made ready to their hands, and in a perfect state of repair and efficiency—is a sufficient proof that the failure of the Caledonian Canal, in a commercial point of view, is due to causes beyond the control of the Commissioners. So long as the canal shall continue under the charge of the Commissioners, they will spare no efforts to improve the prospects of the navigation ; but they are persuaded that the management of such an undertaking would more properly be entrusted to the enterprise of private capitalists.

In 1868 the question of closing the canal altogether was again seriously considered, and Sir John Fowler was called on to go into the question of

cost. His estimates, however, are said to have amounted to over £1,000,000, and the idea of closing—coupled with all the precautions it would be necessary to take in the public interest—was once more laid aside.

ROYAL COMMISSION ON CANALS AND WATERWAYS.

Notwithstanding the expression of opinion by the Caledonian Canal Commissioners in 1860 in favour of a transfer to private enterprise, the canal has remained under State control ever since, though the policy of successive Governments or Government Departments has been to do no more than ensure its actual maintenance.

Witnesses examined before the Royal Commission on Canals and Waterways (1906-9) said the Caledonian Canal had become practically obsolete for the purposes of commercial navigation. Modern shipping requirements, they said, had completely outgrown the facilities afforded by locks designed a century ago, when Telford's ideal of a perfect waterway was one that would accommodate a 32-gun frigate—the fast-sailing cruiser of his day. The locks were not only worked by old and antiquated methods but were of insufficient dimensions in regard alike to length, breadth and depth. Trading and passenger ships passing through them had to be specially designed to suit their proportions. In addition to inadequate depth in the artificial waterways, other impediments to navigation were spoken of as due to the large number of locks, the numerous sharp bends in the line of route, the restrictions on speed and the detentions due to the possibility of vessels having to wait for the tide before they could enter or leave the sea locks at either end of the canal. Under these various conditions, it was said, vessels generally found it preferable to avoid the canal altogether by taking the route round the northern coast.

Proposals were put before the Royal Commission for the carrying out of an improvement scheme on the following basis:—Replacing the existing twenty-nine locks by sixteen new ones, each 600 ft. long, 80 ft. wide and 30 ft. deep, with an average lift of about 16 ft. ; widening at the sharp bends by cutting away the sides ; widening and deepening throughout so as to give a depth of not less than 30 ft., an average width of 120 ft. at the bottom and of 180 ft. at the water level ; lowering the present summit level of Loch Oich to that of Loch Lochy, and dredging a channel through the shallow parts of Loch Oich to a depth of 30 ft. and a breadth of 200 ft. ; altering the entrances at either end to permit of more convenient access or exit, and the dredging of a straight channel from the mouth of the canal at Inverness seaward for a distance of over two miles, with a depth of not less than 30 ft. at low water of ordinary spring tides, and an average breadth of 200 ft. The estimated cost of all these works—the carrying out of which would occupy about three years—was put at £2,200,000.

Other witnesses, however, were unfavourable to the proposals, their view being that the canal already had sufficient capacity for the smaller classes of vessels which were alone likely to use it, and did, in fact, already

use it ; that if the canal were enlarged, to render it capable of taking vessels of a greater size, the saving in time would not be an adequate return for the dues to be paid, and that the patronage of the canal by large sea-going vessels would, in all probability, not be sufficient to provide for payment of interest on the outlay.

On these questions of finance the then resident engineer, Mr. J. G. Davidson, said that even under existing conditions, a great number of vessels which might use the canal refrained from doing so on account of the dues. They preferred to take the Pentland Firth route and save the sixpence per ton it would cost them to go through the canal. They might, however, one may suggest, have been further influenced by the consideration that, in going through the Caledonian Canal, they would require to pass through the aforesaid twenty-nine locks, and they may have doubted whether, with these disadvantages, and the possible delays at either end, they would get good value for their money if they paid the dues and made use of the canal.

In the result the members of the Royal Commission said in their report :—

We do not feel able, after careful consideration of the arguments on either side, to recommend that there should be any expenditure of public money in making the considerable enlargement of the Caledonian Canal suggested.

TRAFFIC CARRIED.

Owing to the limitations in the facilities offered, coasting steamers which, it is believed, would otherwise use the canal are unable to do so inasmuch as vessels built specially to meet those limitations would be too small for the requirements of the coasting services. Consequently the traffic now dealt with is mainly that of fishing craft, trawlers and drifters from the east coasts of Scotland and England, included therein being numerous boats from Yarmouth and Lowestoft. These vessels make many visits annually to the fishing districts on the west coast of Scotland, the industry being one that is rapidly increasing. It is, in fact, becoming more important every year. On occasions as many as one hundred vessels will be waiting to enter the canal at one time. Much inconvenience also arises on the canal itself owing to the antiquated arrangement by which the boats have to ascend or descend eight locks in a single flight.

Among the larger vessels using the canal are some which, belonging to Carnarvon or Port Dinorwic, convey slates from North Wales, or potatoes from Ireland, to east coast ports, returning with slag or artificial manure. Some of them are of about 400 tons burden, and they only just manage to navigate the present canal with safety ; but they prefer to go by this route rather than take the north-about passage, with its mists, adverse tides, and other risks. The largest vessel of all that has ever passed through the canal—and this was in the days before the depth of water in the artificial sections had been decreased in the way already described on pp. 29-30—was one that carried 800 tons of timber and drew 17 ft. 6 in. of

water ; though she was got through only by a special increase of the water in the reaches, raising it above the normal level.

WAR-TIME EXPERIENCES.

On the outbreak of war, the traffic through the Caledonian Canal underwent some very material changes. The fishing industry was greatly interfered with on account not only of the restrictions imposed on its continuance but, also, of the commandeering of so large a number of drifters and trawlers for Admiralty service—a condition which also applied to many small cargo steamers, found so useful for purposes of the war. The rise in freights and the scarcity and high price of coal, combined with the scarcity of shipping, further tended to curtail the ordinary goods traffic. There was, also, a practical suspension of tourist and passenger services for the duration of the war.

On the other hand, considerable use was made of the canal for Admiralty purposes, and in this respect the waterway certainly did, within the limits of its capacity, fulfil the predictions its original designers had made as to its possible usefulness to the country in time of war.

Comparing, first, the traffic for the financial year ending April 30th, 1913, with the corresponding periods for each succeeding year to 1920, we get the following table in regard to the canal traffic as a whole :—

PASSAGES BY	YEAR ENDING APRIL 30.							
	1913	1914	1915	1916	1917	1918	1919	1920
Sailing vessels and boats	286	184	171	106	136	164	1,201	190
Steamers.	2,057	2,246	2,534	1,876	1,969	2,441	4,238	2,726
Total	2,343	2,430	2,705	1,982	2,105	2,605	5,439	2,916

These figures include services rendered on Admiralty account as follows :—

Year ending April 30,	Number.
1914	— ¹
1915	326
1916	445
1917	216
1918	541
1919	3,715
1920	1,011
Total	6,254

¹ The figures for the year ending April 30th, 1914, are not recorded, but they are stated to have been "probably not numerous."

The vessels thus using the canal on his Majesty's service (and doing so, under the authority of early Acts of Parliament, without paying any dues or contributing to the upkeep of the waterway) included a considerable number of Admiralty trawlers, drifters, tugs, boom-defence vessels and such other war vessels as were able to pass through the canal with a view to counteracting the enemy's submarine designs, more especially on the west coast ; but, as suggested by the figures given above, it was in the year ending April 30th, 1919, that the Caledonian Canal rendered the greatest service of all in connection with the war.

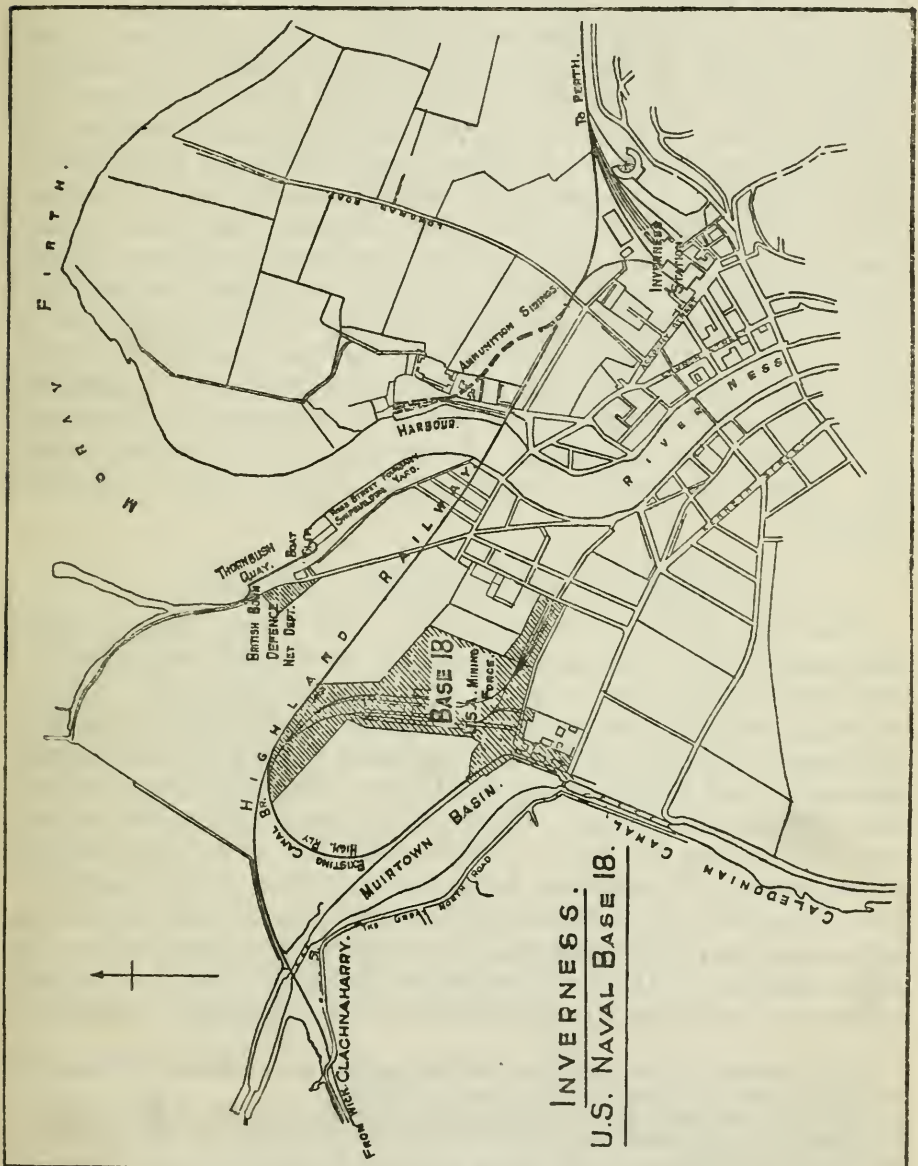
In the autumn of 1917, as already told by the present writer in his book on " British Railways and the Great War," it was arranged that, following on her entrance into the war, the United States should join with us in the construction of the Northern Barrage—an immense minefield designed to stretch across the North Sea from the Orkneys to the Norwegian coast and exclude enemy submarines from the Atlantic. The actual length of the minefield as thus planned and duly carried out was about 235 miles, and the number of mines required to complete the work was about seventy thousand. The arrangement made with the United States Government was that they were to undertake the construction of large quantities of component parts of these mines and ship them over to Scotland. There the parts would be assembled for conversion into complete mines which, after being tested, would be put on American mine-layers and taken out to the North Sea.

For the purposes of this undertaking, two U.S. Naval Bases, known as " 17 " and " 18 " respectively, were set up in Scotland, the former—served from Kyle of Lochalsh, on the west coast, by the Highland Railway—being at Dalmore, on the north shore of Cromarty Firth, and the latter adjoining Muirtown Basin, at the northern or Inverness end of the Caledonian Canal. It is with U.S. Naval Base 18 that we are here alone concerned.

The mines and sinkers dispatched to this destination from the United States, beginning early in April, 1918, were brought across the Atlantic to the western end of the Caledonian Canal at Corpach. There they were transhipped into lighters having a capacity of about 100 tons and so conveyed along the full extent of the canal to Muirtown Basin, the waterway being buoyed and lighted throughout in order that the transport could proceed by night as well as by day. The barges were manned by British naval ratings under the supervision of the British Senior Naval Officer at Inverness.

The United States War Unit having charge of the operations at U.S. Naval Base 18 began to arrive at Muirtown in January, 1918, and the Force eventually consisted of about 1,000 officers and men. For the purposes of the work an area of forty-five acres alongside Muirtown Basin, and served by branch lines and sidings of the Highland Railway, was taken over, various workshops, stores, etc., being erected thereon. A distillery, hotel, and other existing premises were utilized for additional stores, offices, hospital, and officers' quarters, or otherwise. When the

loaded barges from Corpach arrived at Muirtown, the mine parts brought in them were removed by American sailors forming part of the U.S. War Unit and conveyed in railway wagons for the short distance to the work-



shops. There they were to be put together, completed and tested. These operations concluded, they were next taken to the large American mine-layers awaiting them in the Kessock Roads, Inverness, not far from the eastern entrance to the Caledonian Canal, and so on to the minefield in the North Sea.

The amount of traffic in the form of mines, sinkers, explosives, provisions, naval stores, etc., thus carried on the Caledonian Canal from Corpach to Inverness, either for U.S. Naval Base 18 or for the use of the American Naval Forces on the North Sea, had, by the time the Armistice was signed in November, 1918, or shortly afterwards, attained a total of 48,000 tons; and the question arises whether, by the work done in this direction, and, also, in that represented by the sum total of 6,261 passages on Admiralty account in the years from 1915 to 1920 inclusive, the Caledonian Canal, in spite of all its imperfections and shortcomings, had not at last fully justified its existence and given good value from a national point of view for all it had cost. It certainly might have done more had its capacity permitted of war vessels of a larger size passing along the waterway, and a great advantage would have been gained if the vessels bringing the mines across the Atlantic could have continued their voyage through the canal right up to Inverness. Still better would it have been if the American warships, also, could have reached the North Sea by this route. In any case it must be admitted that the Caledonian Canal did more during the war period to establish its utility and to foreshadow the possibilities of an extension thereof than it had done during the previous century of its troubled and discouraging existence.

TRANSFER TO THE MINISTRY OF TRANSPORT.

Under the Ministry of Transport Act, which became law on August 15th, 1919, all the powers and duties of any Government Department in relation to, among other means of locomotion and transport, "canals, waterways and inland navigations" were to be transferred to the Ministry of Transport as from such date or dates as his Majesty in Council might determine; and the Caledonian and Crinan, being State-owned canals, came within this definition. The Order in Council vesting them in the new Ministry was not made, however, until July 2nd, 1920, and the actual transfer of the powers, duties and properties of the Caledonian Canal Commission to the Ministry of Transport took place on August 15th in the same year, from which date the said Commission ceased to have an official existence.¹ Their one hundred and fifteenth report, for the year ending April 30th, 1920, was the last of the series to be issued to the public.

¹ The constitution of the Caledonian Canal Commission when the Ministry of Transport Act became law on August 15th, 1919, was as follows:—

Ex-officio Commissioners:—The Speaker (Chairman), the Chancellor of the Exchequer, the First Lord of the Admiralty, the Lord Advocate and the Member of Parliament for the County of Argyll.

Appointed Commissioners:—The Right Hon. Lord Lovat, K.T., C.B., D.S.O., Mr. James E. B. Baillie of Dochfour, Colonel Malcolm, C.B., of Poltalloch, the Duke of Argyll, the Marquis of Breadalbane, K.G., Mr. Alfred Donald Mackintosh of Mackintosh, Sir Thomas Mason of Craigiehall and Captain Donald Walter Cameron of Lochiel.

Secretary:—Mr. F. C. Bramwell, House of Commons, Westminster, S.W.

Engineer and Manager:—Mr. L. John Groves, M.Inst.C.E., Ardrishaig.

Mr. Groves retired from the position of Engineer and Manager of the Caledonian and Crinan Canals in October, 1921. He was succeeded on the former by Mr. Eustace W. Porter, M.I.Mech.E., Assoc. M.Inst.C.E., and on the latter by Mr. A. E. Bly.

A further result of the new conditions brought about by the passing of the Ministry of Transport Act was an increase in the tolls, rates and charges in respect to both canals.

In the case of the Caledonian Canal (the Crinan will be dealt with in the next Chapter), we have seen that the effect of war conditions had been to bring about a material falling off in the ordinary revenue-producing traffic, though concurrently therewith a great expansion had taken place in traffic on his Majesty's service for which no dues were paid. Taking the amount of this last-mentioned traffic carried during the years ending April 30th from 1915 to 1919 inclusive (the corresponding figures for 1919-1920 have not been published), one finds that, if this traffic had been paid for on the basis of the rates and charges applying to commercial traffic, the revenue of the Caledonian Canal would have been increased by £18,880. Then, also—presumably in the interests of the American mine traffic carried free of charge—the Admiralty, as a war-time measure, made an order in January, 1918, restricting the right of navigation of the Caledonian Canal to his Majesty's ships in Government employment or to vessels to which special permits had been granted.

As the result of these adverse financial conditions, the engineer and manager of the Caledonian Canal had occasion to point out in his general report for the year ending April 30th, 1918, that the traffic handled had failed to produce sufficient revenue to meet the cost of working and maintenance.

Hence it was that in April, 1920, public notice was given, under the Ministry of Transport Act, 1919, that an application had been made to the Minister of Transport to sanction and direct increases in the rates, tolls and charges in force on the Caledonian and Crinan Canals, and that notices of objection thereto were to be sent to the Rates Advisory Committee by a specified date. Such increases were made, and they came into effect on August 2nd, 1920.

Having regard to the fact that a large sum would shortly have to be expended on repairs and renewals in connection with the Caledonian Canal, the Inverness Chamber of Commerce made strong representations to the Caledonian Canal Commissioners early in 1919 in support of the improvement of the waterway in the interests of shipping and of the communities residing in the Great Glen ; but in a reply thereto received by the Chamber it was said :—

The Commissioners understand that it is the intention of his Majesty's Government to include the Caledonian and Crinan Canals in the Bill which is now before Parliament for the establishment of a Ministry of Ways and Communications, and, if that Bill passes into law, the canals will be vested in the new Ministry, and the Caledonian Canal Commission will cease to exist. The future of the two canals will then be for the Ministry to determine, and it appears to the Commissioners inexpedient that they should take any action or initiate any policy which may prejudice the decision of the Ministry, or hamper its freedom in dealing with the matters which will pass under its control and for which the Commissioners will cease to have any responsibility.

MORE REPAIRS—AND STILL MORE NEEDED.

In the case of ordinary barge canals which are no longer wanted and are not worth spending any more money upon, they may—provided they are not owned by railway companies under statutory obligations to maintain them—be very well left to become derelict and share the fate of so many earlier canals belonging to independent companies, nobody except, perhaps, an occasional writer to the newspapers, troubling further about them.

In the case, however, of the Caledonian Canal, from whatever point of view its utility may be regarded, this expedient is one that cannot be followed.

When, over a hundred years ago, the Government of the day, influenced, as "Blackwood's Edinburgh Magazine" said in 1820 (see pp. 14-15), by "the noblest motives which can actuate the human mind," set on the unemployed of the Scottish Highlands to construct the Caledonian Canal, they also assumed the responsibility of interfering with the handiwork of Dame Nature by cutting away or weakening the natural barriers holding in check the waters of a series of lakes ranging in length from four miles to twenty-four miles, and situate at elevations of from 51 ft. to 106 ft. above sea level. These considerable expanses of water have thus far been kept under control by weirs, artificial banks and locks the condition of which under water is in many cases not such as could be desired; and it has been shown that there are points along the canal where the failure of a lock or a bank would mean the letting loose of immense volumes of water to flood a wide expanse of country, with the certainty of doing vast damage to property, and the possibility of leading to a lamentable loss of human life. It will thus be seen that the canal cannot be allowed to become derelict, and that to abandon its use for purposes of navigation would involve very considerable expenditure in the construction of permanent works for safeguarding the surrounding district.

That these are not imaginary dangers must be evident to every one who realizes the physical conditions under which the canal has been built, and, also, takes the trouble to search the reports of the Caledonian Canal Commissioners for definite facts. From, for example, the 38th of the series, for the year ending April 30th, 1843, one learns that for some years previously the Commissioners had pointed to the possibility of disaster through a failure of the Gairloch lock, in which event the waters of Loch Lochy, which cover an area of 6,000 acres and had a depth of 27 ft., might have been emptied into the Corpach valley; while in January, 1843, there were serious apprehensions of such an occurrence really happening. As the result of heavy floods, the water rose in Loch Lochy to a higher level than had ever been known before except during a similar crisis in the winter of 1834; a portion of the masonry adjacent to the lower lock gates gave way under the pressure, and temporary repairs had to be carried out, in tempestuous weather, under conditions of great difficulty and anxiety. It was scarcely possible to keep pace

with the rise of the waters, which, at one time, were 2 ft. 6 in. above the lock gates ; but, as the result of operations continued for three weeks, the danger was averted, the canal works were saved from almost certain destruction, and, most providentially, the repairs done prevented another inundation which threatened the district shortly afterwards.

Coming down to a more recent period, one finds an abundance of evidence as to defective and even dangerous conditions in this State-owned waterway. In his report for 1910-11 the engineer and manager said concerning the masonry of the locks :—

Two portions of lock walls were taken down and rebuilt during the past summer. The walls were badly bulged and it was considered unsafe to defer the work longer. The masonry was found to be in a very bad state, the mortar having been washed out, stones and sand and mud only remaining. Many portions of masonry at Corpach, Banavie and Fort Augustus are bulged and have been so for many years. . . . It is quite evident that the masonry of most of the locks will require a very extensive repair. . . . The canal was opened for traffic in 1822 and by 1843 the masonry was found to be in such a bad state that the canal was closed for three years, and large sums were expended in renewing *portions* of the masonry, etc. What was then left of the original masonry is what is now giving trouble, and, considering that it has been in constant use for 89 years, and being bad originally, it is only surprising that it has stood so long.

In the following year Mr. Groves reported :—

A portion of the south side of the lower Corpach Lock was taken down and rebuilt. This wall and also the bulged portion of the Banavie top lock were found to be in a very bad state, the mortar having been entirely washed out and only mud and sand remaining. The stones with which the walls were built were small and irregular, the whole having been originally badly built. This latter remark applies to nearly all the masonry in the middle and west districts.

These conditions were confirmed in the report presented in 1913, though it was then said that—

Anything in the shape of a thorough and systematic repair would entail such a very large expenditure of time and money that, for the present, the most feasible plan seems to be to keep a careful look-out for any portions threatening to give way, and, as necessity arises, to stop traffic and patch them.

Outlay, it was further stated in the same report, would be more especially involved in the renewal of under-water work, much of which was in a very bad state, while in many places the need would arise for putting in expensive coffer-dams to allow of the repairs being carried out. On this point the engineer said :—

Fifteen of the *twenty-nine* locks can only be emptied for examination or repair "in the dry" by the construction of expensive dams or coffer-dams, for the engineers who were responsible for the 1843-1846 repair omitted (even in the case of the new lock then built at Gairloch) to make any proper provision for "unwatering," by means of a "caisson" or "stop-gate," such locks as are below tide-level, or below the level of the three lakes. Thus the repair to the Corpach lock in 1911 was of necessity all *above* tide-level, whereas the cause of the subsidence (if there is subsidence) is *below* that level.

Under war-time conditions the state of the masonry, at least, went from bad to worse. In consequence of enlistments, and in view of the

falling off in revenue, the canal staff was reduced as far as the efficient working of traffic would permit, and no maintenance work was undertaken apart from what was absolutely necessary and could not be postponed. By June, 1919, the staff was again at its normal strength, the men who had been engaged on military service having been released, and it was possible to overtake gradually the maintenance work which had been delayed on account of the war.

More than this, however, was wanted. By the end of 1919, the general repair which should have been effected in 1915 but had been delayed on account of the war and the course of events following thereon, was much overdue, while, in addition to the defective condition of the works under water, the canal had suffered much damage as the result of the heavy traffic, night and day, which had been carried under war-time conditions. It was, in fact, reported to the Commissioners that a stoppage of the canal early in 1920 for nine weeks to allow of the necessary repairs being carried out would be unavoidable, such stoppage being for a longer period than usual. The cost of the work to be done was estimated at £11,000. Representations to this effect were made to the Ministry of Transport, a grant for the amount stated was obtained, and the general repair was carried out accordingly.

“NEPTUNE’S STAIRCASE.”

For the comparatively small sum of £11,000, no under-water work could be undertaken, and what was done—apart from repairs to banks, etc., in the numerous curves, where much damage had been caused during the war by vessels whose crews were unfamiliar with them—consisted mainly of a good deal of useful strengthening of the flight of eight locks forming “Neptune’s Staircase,” at Banavie. Here the conditions were particularly bad. Of the fourteen locks on the canal which, in the total of twenty-nine, can alone be dried out apart from the use of temporary dams, seven are in the Banavie flight; and, on these being so dealt with, it was found that, except for portions rebuilt in 1843–6, the masonry was of the worst possible class. It seemed, in fact, almost incredible that so eminent an engineer as Telford could possibly have passed such inferior work, and how it could have stood for a hundred years without giving way altogether was inconceivable. Unfortunately, also, any repairs of these locks since 1846 had been done during short stoppages of only two or three weeks each, at comparatively long periods, and they had, therefore, been quite inadequate; whilst even in the nine weeks now available it was not possible to do more than make good some of the most defective work, thus allowing of the canal traffic being carried on for a few more years until the time comes for the next general repair. It was also found at this point that eight gate recesses which had not been rebuilt in 1846 had been originally constructed of the most irregularly-coursed rubble masonry, with hollow quoins of soft, friable red sandstone, many of which were fractured and crumbling away.

ON THE VERGE OF COLLAPSE.

Much attention had likewise to be paid to the locks at Corpach, the western end of the canal, where two connected locks, a basin and the Corpach sea-lock give access to Loch Eil and thence to Loch Linnhe and the Atlantic. These locks are founded on rock; but their original construction must have been as bad as that of the locks at Banavie. At the lower end, indeed, of the two connected locks, part of one of the side walls was found on the verge of collapse. It is true that these two locks were supposed to have been repaired in 1843-46; but, unfortunately, that repair left much of the original inferior work untouched and was by no means thorough. For instance, the coffer-dam, instead of being formed on the outside of the sea-lock, as it should have been, was actually placed across the Corpach basin, so that the sea-lock was excluded from the repair operations and, except for frequent patch-work by divers, has received no effective repair since its construction over a century ago.

The portion of the badly-bulged side wall, described above as "on the verge of collapse," was found to consist of an outer skin of very poor building 18-in. thick, with a vacant space behind it large enough for a man to stand in, and behind that again nothing but loose irregular stones with no binding material but mud. A tide-work and patch-work repair was effected, making the wall comparatively safe for the time being; but the wonder is that a collapse had not occurred long ago.

Inasmuch as the whole of the fifteen locks which can be properly repaired only by means of coffer-dams are about a hundred years old, it cannot be long before the question of thorough repairs will have to be considered. The Laggan Locks, between Loch Lochy and Loch Oich, are perhaps in as bad a condition as any; though it is in the case of those at Dochgarroch, above Inverness, and at Cullochry, above Fort Augustus, that the results of a collapse would be the most serious.

THE FUTURE OF THE CALEDONIAN CANAL.

The present situation is thus found to be that the Government, as responsible owners of the waterway, are still faced by the prospect of a heavy expenditure, in the near future, on under-water and other works if the canal is to be kept going as an alternative to abandoning it at, in that case, the still substantial cost of precautionary measures necessary to prevent it from becoming a source of danger to property and communities in the lower parts of the Great Glen.

Of these alternatives the former would be preferable; but the question arises whether, instead of undertaking a heavy repair which would do no more than maintain the canal as it is to-day, with all those twenty-nine locks, it would not be a more practical procedure to modernize the waterway, getting rid of some of the disadvantages it offers, and increasing its proved utility.

Here one is bound to recall the fact that, as already stated on p. 32, the Royal Commission on Canals and Waterways did not feel able to

recommend an expenditure of public money on making the considerable enlargement of the Caledonian Canal which had been suggested to them. But once more it was a case of the canal "not having a chance." The proposals laid before the Royal Commission emanated from a Caledonian Canal Development Association which had then been recently formed at Inverness; but these proposals had not first been submitted to the Caledonian Canal Commissioners or considered by them. When, also, after their presentation to the Royal Commission, they could be considered by the expert staff of the Canal Commissioners, they were regarded as impracticable inasmuch as they would still leave vessels to pass through sixteen locks, while the construction of a large extent of artificial, puddled and watertight embankment was regarded as altogether inexpedient. In addition to this, it was thought that the cost of carrying out the proposed works had been much underestimated.

RECONSTRUCTION SCHEMES.

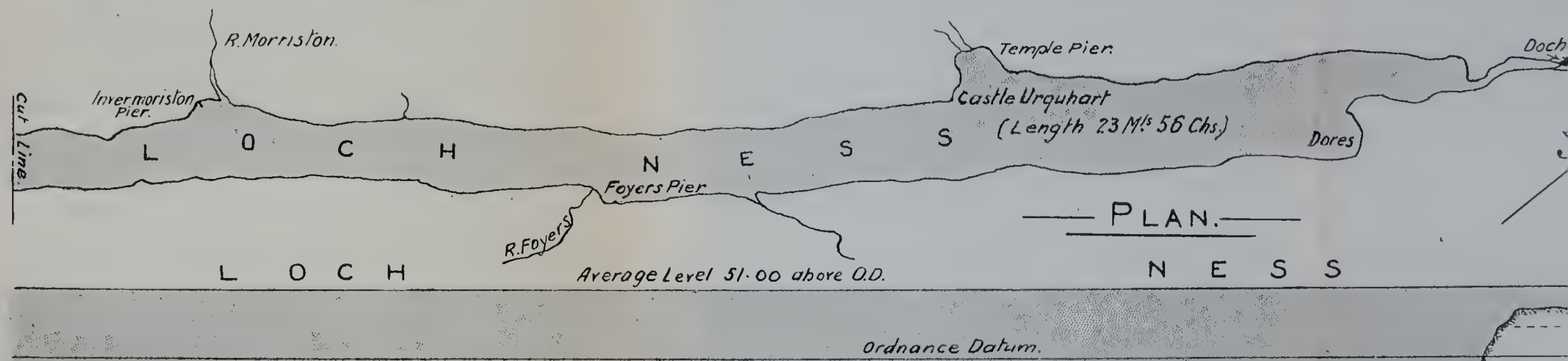
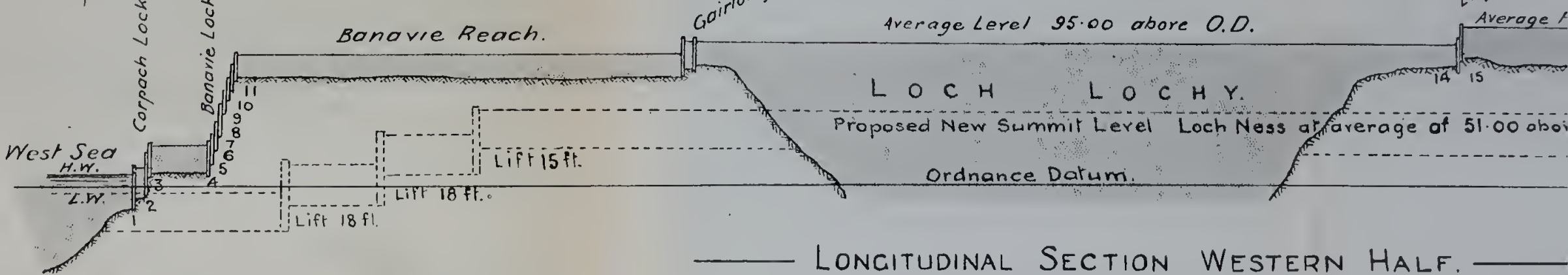
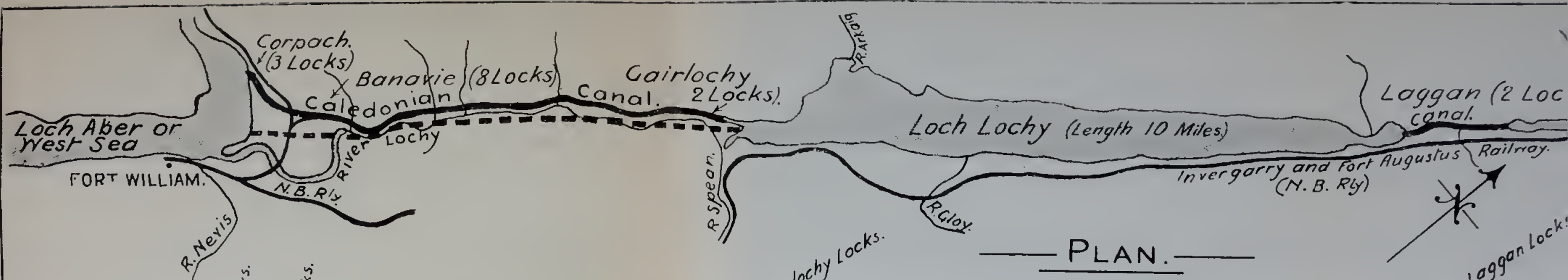
In point of fact, the scheme put before the Royal Commission was abortive, and in its place there was afterwards proposed by the engineer and manager of the canal another which aimed, not alone at providing locks of a larger size, but at reducing their number from twenty-nine to six. This was to be done by making Loch Ness, at an elevation of 51 ft. above Ordnance datum, the summit level in place of Loch Oich, at an elevation of 106 ft. above Ordnance datum. Mr. Groves also proposed to construct new outlets at either end in order to ensure that vessels could enter the canal at any state of the tide, thus avoiding the present delays. The line of the projected new canal, designed to constitute a real ship canal on the Loch Ness level, will be seen from the plan and longitudinal section facing this page, while the general advantages claimed for the scheme may be stated thus:—

1.—No troublesome "flights" of locks of ancient design, many of them badly constructed and in poor condition, more than half of them inaccessible for repair except at extravagant cost, and all of them too small for modern requirements, while causing inconvenience and delay to such vessels as they are able to accommodate.

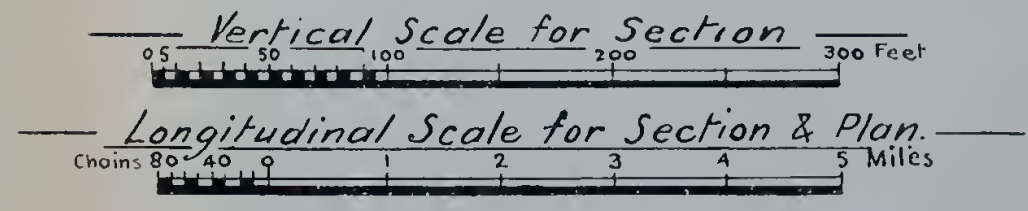
2.—Substitution for the existing twenty-nine locks of six locks only, three at each end, these being of modern design, ample size, mechanically operated, with proper provision for inspection or repair at any time, and having dimensions approximately as follows, as compared with the existing locks:—

	LENGTH.	BREADTH.	DEPTH.
Proposed new Locks	500 ft.	60 ft.	26 ft.
Existing Locks	160 ft.	38 ft.	15 ft.

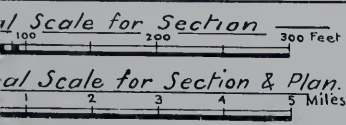
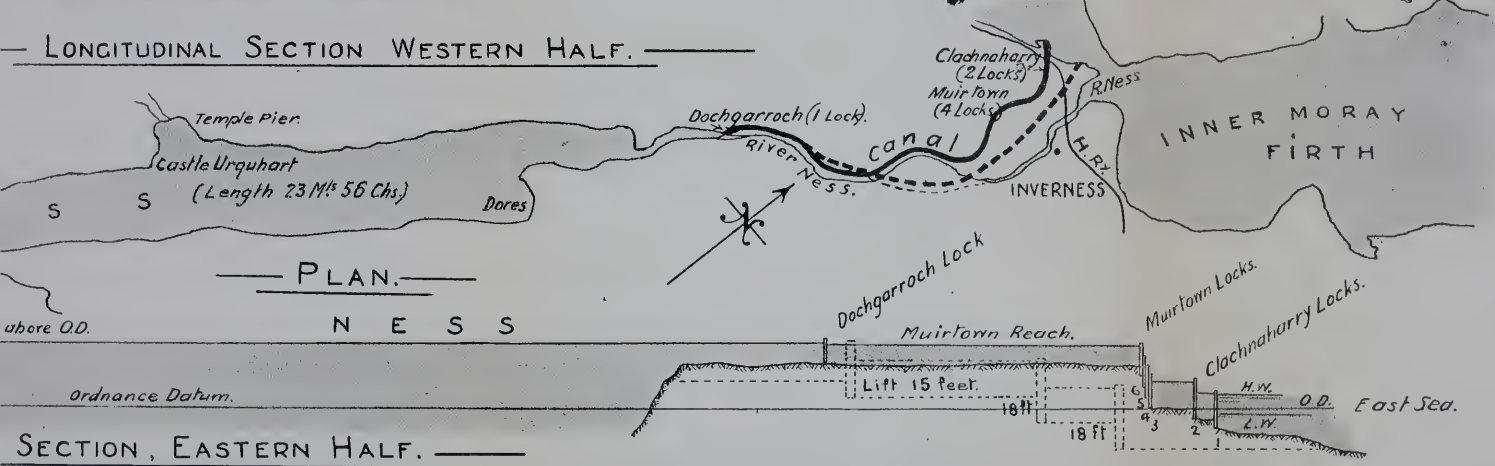
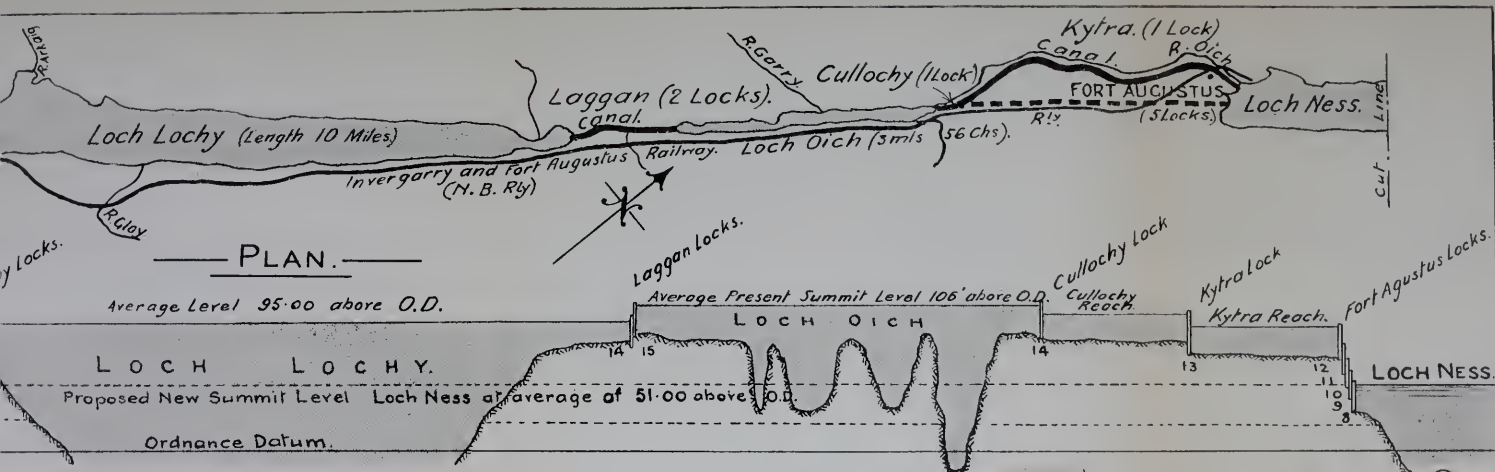
3.—The new locks, having, say, eight and a half times the capacity of those now in use, and supplemented by intervening basins, would, together with the waterway, be large enough to pass all existing shipping between east coast and west coast ports, or between west coast and Baltic



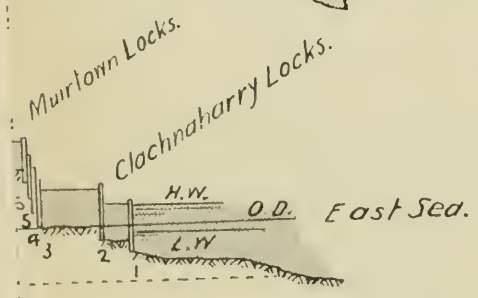
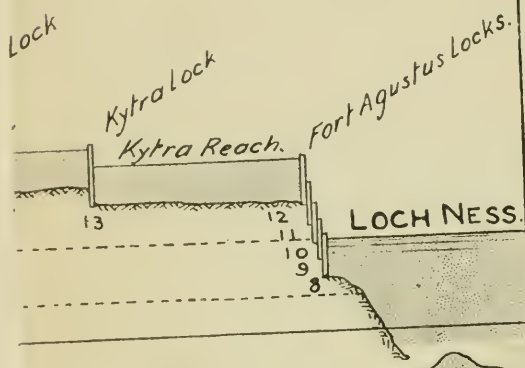
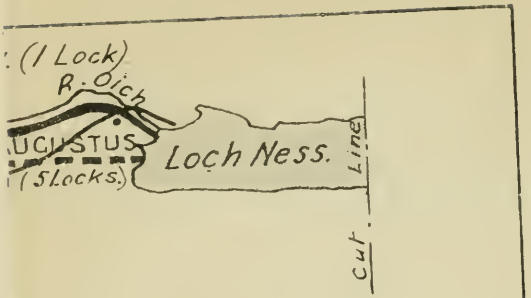
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 Proposed Canal.
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CALEDONIAN CANAL.
PLAN AND LONGITUDINAL SECTION.
Showing Reconstruction Scheme, based on Loch Ness as the new Summit Level, proposed by Mr L. John Groves M. Inst. C.E.



TION. _____
Loch Ness as the
in Groves M. Inst. C.E. _____

ports, the greatest possible crowd of "drifters" without any detention whatever, and, also, the smaller craft of H.M. Navy, such as gunboats, destroyers, submarines, etc.

4.—Swift and modern passenger steamers could ply between Oban and Inverness without any need arising for change of boat or transfer of luggage.

5.—With a summit level embracing all three lakes—Loch Oich, Loch Lochy and Loch Ness—together with their watersheds, there would be a magnificent area for an assured summit water supply, while, save for swing bridges which would cause no delay, vessels would get an uninterrupted run of about forty-seven miles between the summit lock (having a 15 ft. lift) at the Banavie end (where "Neptune's Staircase" would no longer exist), and the corresponding summit lock near Dochgarroch, at the Inverness end, a much quicker passage than is at present possible being thus assured.

6.—Access at both ends available at all states of the tide instead of, as at present, for only eight hours out of every twelve.

7.—No more continual anxiety lest some of the old, badly constructed works should give way, and have to be repaired under difficult conditions.

8.—No more puddled "watertight" embankment (as in the present Banavie Reach), with the constant danger of leakage and possible failure.

9.—Greatly improved transport facilities for the proposed water-power works along the canal, while the lowering of the present summit by over 50 ft. would increase proportionately the head of water available at Invergarry, would make the fall between Loch Arkaig and Loch Lochy worth developing, and would, also, ensure an effective and constant regulation of the water supply generally, without any cost to the works concerned.

10.—Considerable reduction in labour costs, per unit of tonnage carried on the canal, owing to the reduction in the number of locks and their mechanical operation.

From a strategical point of view a ship canal of this type, passing through the Great Glen of Scotland, would have been more especially of value if the Admiralty had considered the naval base established by them at Invergordon in the early days of the war of such importance as to be worth maintaining permanently. The question might then have arisen as to whether the proposed enlargement of the Caledonian Canal should or should not be on such a scale as would ensure locks and waterway of battleship dimensions.

Invergordon, situate in Cromarty Firth, is about thirty miles from the head of the Caledonian Canal at Inverness, and the canal itself could have been reached by sheltered waters, while the approach to Inverness from the Moray Firth had already been deepened by the Admiralty for the use of warships. Assuming that Invergordon had been made into a first-class naval base, as a "Portsmouth of the North," and that in some future war the enemy had closed up the exit from Moray Firth to the sea, a

Caledonian Canal of battle-ship dimensions might have served a most useful purpose as an alternative route to or from the west coast.

These considerations are to-day nullified by the fact that the naval base at Invergordon has been regarded as having served its special purpose in the Great War, is not to be continued at all, and, as these lines are being written, has practically disappeared. The workshops have been dismantled and the machinery sold off, while the Fertiliser Company which occupied part of the site when the Admiralty took possession has been allowed to return thereto—a new rendering, from a naval instead of a military point of view, being thus given to the Old Testament saying, “They shall beat their swords into ploughshares.” The dockyard and the implements of warfare at sea have gone, and in their place has come—the manufacture of artificial manures!

It would seem therefore that the Caledonian Canal can no longer claim the degree of strategic importance it might otherwise have had, and that there is less reason to-day than ever for expecting such support from the Admiralty as would justify the great difference in cost between an improved waterway of battle-ship size and one large enough to accommodate any commercial craft by which it was likely to be used. All the same, it is evident that modified improvements on the basis of those outlined above should still be of real advantage to H.M. Navy in so far as they would permit of larger types of war vessels passing through the canal than is possible under present conditions.

ALTERNATIVE PROPOSALS.

To provide against the possibility of his scheme (which may here be described as “Scheme A”) for a reconstructed Caledonian Canal on the Loch Ness level, with locks 500 ft. in length, being regarded as prohibitive in respect to cost, Mr. Groves has suggested an alternative (“Scheme B”), on the basis of the canal having a new summit on Loch Lochy, itself to be lowered from an average level of 95 ft. to one of 85 ft. The number of locks would, under this alternative scheme, be reduced from twenty-nine to not more than ten (instead of six, as in Scheme A), and these would have dimensions as follows:—Length, 350 ft.; breadth, 55 ft.; depth of water over cills, 21 ft. “Neptune’s Staircase” would still be done away with, and so, too, would be that further source of much trouble—the artificial puddled bank of the Banavie Reach.

Then the length of the lowered Loch Lochy would be extended westward for about three miles by the construction of a dam across the river Lochy at a point between Camisky and Torcastle. From this dam the West Sea would be reached by five locks, namely, four with a lift of 17 ft. 6 in. each, and one with a lift of 15 ft. Incidentally, inasmuch as the reduced summit level would be the same as that of the present Banavie Reach, a portion of the latter could, if desired, be used for the supply of water for power purposes at Banavie.

Going eastward, the 85 ft. summit level would be carried towards Fort Augustus, lowering the present level of Loch Oich by 21 ft. ; and between

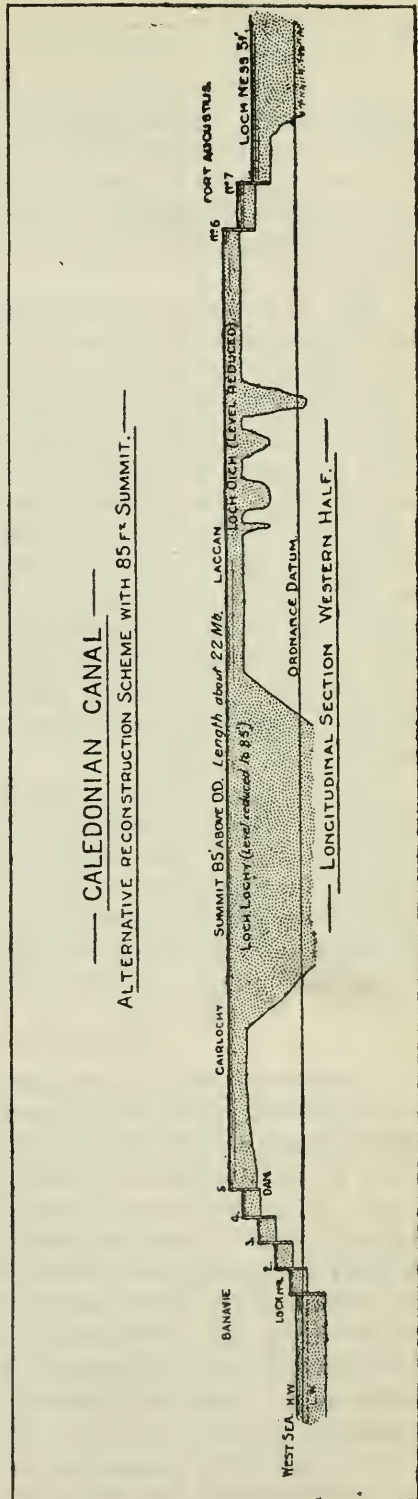
Kytra and Fort Augustus there would be two locks to overcome the drop of 34 ft. to the Loch Ness level of 51 ft. From Loch Ness the East Sea would be reached by three more locks, as in the proposals based on a Loch Ness-level summit.

In the order of merit, Scheme A represents the *best possible*, and Scheme B¹ the *second best*, solution of the problem as to the enlargement and modernization of the Caledonian Canal. This would still be the case if the size of the locks proposed for the former were reduced to the size of those proposed for the latter. The whole question as between the two schemes resolves itself into the difference in cost.

TRAFFIC PROSPECTS.

What this cost would amount to in the case of either cannot be even suggested until surveys have been made and reliable estimates drawn up, no action having yet been taken in these directions. The prospects, also, as to the increase of traffic which might be obtained are to-day no more than a matter of the merest guess-work. Fishing-steamer traffic, now the main item in the revenue, might certainly be greater, since the congestion and delays which may occur when there is a big rush of drifters would be eliminated and the passage to and from the fishing

¹ It will have been noticed that alike in the scheme put before the Royal Commission on Canals and Waterways and in the one referred to above, the summit level is Loch Lochy; but there is an essential difference between the two in so far as the former includes sixteen large locks and a considerable amount of artificial bank, whereas the latter allows for ten smaller locks and a minimum quantity of artificial bank. For dimensions of the locks as proposed to the Royal Commission, see p. 31.



grounds would be made in much less time. It is anticipated, also, that the passenger traffic would be more than doubled.

The uncertain quantity in the situation is as to the number of coasting or other steamers which would use the canal instead of going north-about. Whilst coasting vessels have steadily increased in size during the last hundred years, the Caledonian Canal locks have undergone no expansion since they were originally constructed, and they are now unequal to accommodating the average steamer that might otherwise take this route.

But, one may ask, would ships be likely to use the canal to any material extent in preference to keeping to the open sea round the north of Scotland? As related in the earlier part of the present Chapter, the Caledonian Canal was originally constructed to obviate and overcome the dangers which the passage round Cape Wrath and through the Pentland Firth presented to sailing-vessels in the days when steamships were unknown, and, also, to avoid the serious delays resulting from adverse winds and currents; but, under present-day conditions of powerful steamers for which storms and adverse winds and currents have no longer the terrors of old, there may, indeed, be actual preference for an open sea rather than for the circumscribed limits of a canal, with the accompaniment of locks to be passed through and dues to be paid. Even the tourists who are good sailors might find the imposing scenery of the northern Scottish coast still finer than that of the Caledonian Canal and wish to keep to it accordingly.

The one confident assurance that could be entertained as regards a diversion or an expansion of coasting traffic in favour of an enlarged waterway is that there might be a renewal of the service formerly run between Liverpool and Aberdeen and Leith, via the Caledonian Canal, by a company having a steamship able to pass through the canal locks; though when this vessel was disposed of, the company had no other suitable one which could take its place and the service lapsed.

WATER-POWER INDUSTRIES.

In respect to traffic to or from places situate on the canal itself, the immediate outlook is certainly not promising; yet a material expansion should, sooner or later, follow the undoubtedly great possibilities of water power along or within a convenient transport distance of the Caledonian Canal. At present the only important water-power industry actually on the canal itself is that of the British Aluminium Company, Ltd., at Foyers, on Loch Ness, where the company have been carrying on the manufacture of aluminium by hydro-electro-chemical methods for over five-and-twenty years, the raw material being brought to the factories, and the manufactured metal dispatched, by canal and sea; but in their first interim report, issued in February, 1919, the Board of Trade Water Power Resources Committee said:—

The reports in the possession of the Committee dealing with a portion of Scotland alone show that nine water power schemes hereafter referred to are capable

of generating a continuous supply of 183,500 electrical h.p., corresponding to an output at the hydro-electric stations of 1,200 million Board of Trade units per annum. . . .

Allowing for losses in transmission and transformation, the nine schemes in question could deliver at least 1,000 million Board of Trade units per annum within a radius of supply of from eighty to eighty-five miles.

To the above figures have to be added, in respect to power already developed by the British Aluminium Company, at Foyers, 8,000 h.p., and, at Kinlochleven (immediately south-east of the Caledonian Canal, though not actually on it) 35,000 h.p. The same company have now secured Parliamentary sanction for their Fort William scheme (Lochaber Water Power Act, 1921), designed to furnish a much larger power than that available at Kinlochleven, while a clause in the Act stipulates that, of the total power, namely, 100,000 h.p., a minimum of 5,000 h.p. shall be reserved to meet the requirements of other local industries.

Taking the whole of Scotland north of the Clyde, it is estimated that there is water power still capable of development from lochs and rivers to the extent of, in the aggregate, 500,000 h.p. In the opinion of one especially competent authority on the subject, the bulk of this power would be developed in the Highlands at points situate on the coast, on the Caledonian Canal, or not more than twenty miles distant from the one or the other; so that, for some two-thirds of the potential power in question, the main line of traffic would probably be via the west and south-west coast to the Clyde and other southern ports, thus providing traffic for either the Crinan or the Caledonian Canal, or both. Of the nine power schemes surveyed but not yet developed, one, of 27,000 h.p., would be at Loch Hourn; another, of 12,000 h.p., at Loch Etive, and a third, of about 10,000 h.p., at Invermorriston, on Loch Ness. Then, again, apart from schemes in respect to the western watershed, many of those capable of development in the eastern watershed of the Highlands would also furnish traffic for the Caledonian Canal.

In the Final Report of the Water Power Resources Committee (paragraph 141, p. 43), it is said:—

The conditions in the Highlands of Scotland are very favourable for water power developments. The population is sparse in most of the areas in which water power resources are situated. Yet, owing to the character of the coastline and the position of the Caledonian Canal, no water power site is far removed from a point from which ready access to the sea is obtainable.

Nor should one overlook those timber resources of the Great Glen which as far back as 1799 were advanced by the Rev. James Headrick (see p. 8) as one of the reasons in favour of the "practicability and advantage" of constructing the Caledonian Canal. To-day, also, it is a question, not simply of utilising to a greater extent the existing timber resources of the district, but of effecting a considerable expansion in them. A very large programme for the planting of areas in the Great Glen is already in process of being carried out, and it is intended, when the new timber grows to some extent—and that will not be many years

hence—to establish a pulp mill at some conveniently situated centre, probably at the head of Loch Ness, and, possibly, in the neighbourhood of Fort Augustus. It may certainly be assumed that water power will be used for the working of this mill, which, having regard to the lines likely to be followed for the timber-planting programme, should be of considerable dimensions. So one sees in these developments the prospect of a further material increase in traffic for the Caledonian Canal system at no far distant period.

THE CALEDONIAN CANAL PROBLEM.

There are those who consider that, even allowing for any such future industrial expansions in the Great Glen as might reasonably be expected, the existing capacity of the Caledonian Canal would be likely to meet the requirements of commercial traffic for many years to come ; but if one ignored altogether the possibilities of water-power expansion there, and the expediency of showing foresight in providing for it when the opportunity for so doing arises, one is still faced by the consideration that the Government will be compelled, before long, to incur heavy expenditure on assuring the upkeep, the maintenance and the safety of the present out-of-date canal, even although in so doing they fail to add in the slightest degree to the transport facilities it offers.

The problem of the Caledonian Canal thus finally resolves itself into the proposition already advanced, namely, whether it would not be better to spend the money on actual improvements rather than on mere repairs without improvement

CHAPTER II.

THE CRINAN CANAL.

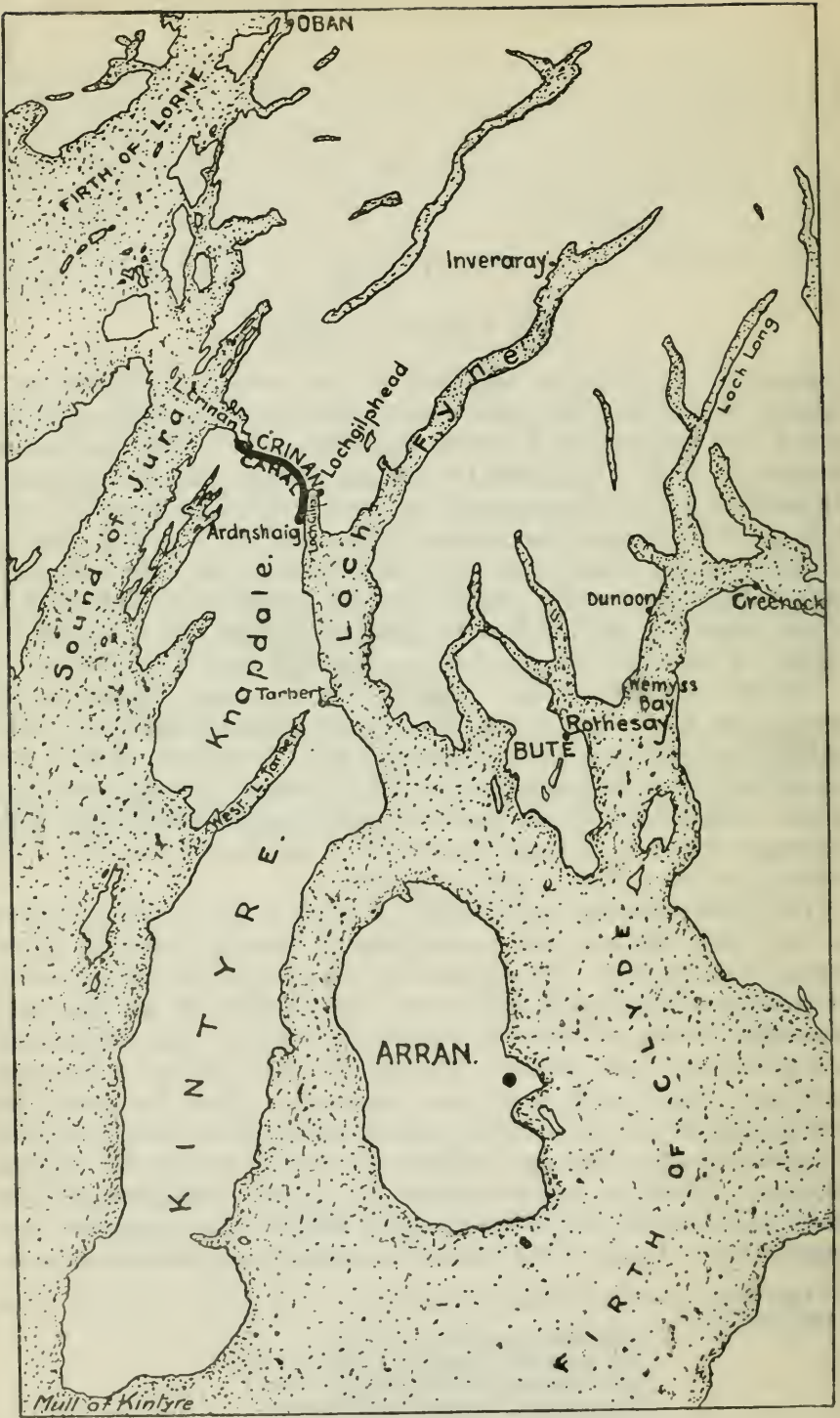
STRETCHING out from the mainland on the west of Argyllshire for a distance of some fifty-five miles in the direction of the Irish coast, the narrow dual peninsula of Knapdale and Kintyre forms a natural barrier between the Firth of Clyde and the Atlantic Ocean. The neck of land at the northern limit of this peninsula, between Loch Gilp, a branch of Loch Fyne, on the east, and Loch Crinan, a branch of the Sound of Jura, on the west, is only about four and a half miles across from high-water mark to high-water mark ; but the distance by sea from Ardrishaig to Crinan round the Mull of Kintyre, the headland at the southern extremity of the peninsula, is over one hundred and thirty miles.

By this circuitous route it was that, at one time, vessels passing between the River Clyde and the Highlands or the Hebrides had necessarily to go, making a voyage eighty-five miles longer than if there had been direct water communication available between Loch Gilp and Loch Crinan. The only exception was in the case of smaller boats which could be dragged across the isthmus between East Loch Tarbert and West Loch Tarbert, no more than a mile in width.¹

The greater distance of the Mull of Kintyre route was not, however, the only consideration—and especially so in the days before the introduction of steamships. The voyage itself was an especially dangerous one for coasting vessels and fishing boats. The currents off the Mull were exceedingly strong and there was a lack of harbours in which vessels could take shelter in stormy weather. Disasters involving the loss of ships and crews were consequently of frequent occurrence. Then the winds that were favourable in one direction became unfavourable immediately the sailing-ships had doubled the headland and required to go in the opposite direction. Should the further dangers due to these conditions be overcome, vessels might still encounter much difficulty and experience prolonged delays. Instances were known of sailing-ships taking three weeks

¹ How Bruce crossed the isthmus is thus described by Sir Walter Scott in his " Lord of the Isles " :—

Ever the breeze blows merrily,
But the galley ploughs no more the sea.
Lest rounding wild Cantire they meet
The southern foemen's watchful fleet,
They held unwonted way ;
Up Tarbert's western lake they bore
Then dragged the bark the isthmus o'er,
As far as Kilmaconnel's shore,
Upon the eastern bay.



THE CRINAN CANAL.

A sheltered passage through the Crinan Canal, for vessels adapted to its limited proportions, effects a saving in distance of eighty-five miles between the Clyde and the Western Highlands as compared with the exposed voyage round the Mull of Kintyre.

to make the voyage between the Clyde and one of the ports in the Highlands or the Western Islands.

All these things were to the prejudice of the shipping, the fisheries and the people living on the west coast, who were more or less cut off from communication with the towns on the River Clyde, and, in consequence, lived a life of isolation and impoverishment.

The only remedy for conditions such as these was to be found in the provision of a waterway communication across the isthmus separating the two lochs at the northern end of the peninsula, thus enabling the fishing boats, and, also, the small sailing-vessels which then did all the sea transport trade of the Highlands and the Western Islands, alike to take the shortest, most direct and most sheltered route and to avoid the delays, difficulties and dangers of the passage round the Mull of Kintyre.

In 1771 James Watt was employed by the Trustees of the Forfeited Estates Fund¹ to survey routes for canals at Crinan and Tarbert respectively. His estimates worked out thus² :—

ROUTE.	DEPTH OF CANAL.	
	7 ft.	10 ft.
	£	£
Loch Gilp to Loch Crinan	34,879	48,405
Isthmus of Tarbert	17,988	23,884

Watt favoured the Crinan route ; but, in the absence of any prospects of adequate financial support, no further action was taken by the Trustees.

JOHN KNOX AND THE CRINAN CANAL.

Reference has been made on p. 7 to the fact that, in his "View of the British Empire" (first edition, 1784; third, 1785), John Knox had included among the three artificial navigations which he regarded as "the groundwork of all succeeding improvements" in the Highlands and in Scotland in general a canal between Loch Fyne and the Atlantic; and of this particular project he became an especially earnest advocate.

Dealing with it more specifically, in his book, he said the notion had long prevailed in Scotland that a cut might be made between Loch Fyne and the Atlantic by way of Tarbert by reason of the shortness of the distance, and he mentioned that "many years ago" he paid a visit to Tarbert to see the position for himself. The conditions, however, did not answer his expectations, and he went fourteen miles further to the north in order to inspect the country between Loch Gilp and Loch Crinan.³ He

¹ This fund was created, under 25 Geo. III, c. 41 (1751-2), by the annexation of estates in Scotland which had been forfeited to the Crown on the attainder of their owners for participation in the rebellions of 1715 and 1745. The Act in question appointed commissioners and trustees to manage the estates and to "apply the produce thereof to the civilizing and improving the Highlands of Scotland and securing the peace and loyalty of the inhabitants."

² For details of estimate, see Appendix 22 to Third Report from the Committee appointed to enquire into the state of the British Fisheries, Reports of the House of Commons, Vol. X.

³ See map on p. 67.

found the conditions there far more favourable, with the additional advantage that a canal by this latter route would save twenty miles of navigation as compared with the Tarbert route. Convinced of the utility of the work and the facility of its execution, he "broached the subject in public," and, after reading the report made by James Watt, he went over the ground again in 1784.

Pointing to the disadvantages and dangers of the long *détour* round the Mull of Kintyre, he went on to say that it was a bold undertaking for small open boats, badly constructed and still worse provided, to incur the risk of the almost incessant gales and the vast number of islands, lee-shores, rocks, sands and currents met with in making that voyage. In the winter it could not be made at all, and the people were then shut out from all intercourse with the seats of industry, population and affluence. Nothing could prove more discouraging to the fisheries than "the hazard, the delay, the expense and the uncertainty of this navigation." He further declared that—

The expediency of a shorter navigation between the Atlantic and the Clyde must appear obvious to every observer. It is a matter not only of national utility, but of moral obligation. It touches the feelings of humanity, and calls aloud for immediate redress. . . .

A voyage which frequently takes up three weeks would, by this easy passage, be performed in four or five days, with fewer hands, and in all seasons of the year. By cutting off the peninsula of Cantire the voyage would be entirely inland and happily screened by the mountains from the dreadful tempests of the Atlantic.

In addition to the advantages which, he predicted, the canal would confer on the fisheries and on the populations of the Highlands and the Islands, from the Hebrides southwards, he pointed to "the expediency, facility and security by which troops and military baggage would be conveyed between the Highlands and the Clyde, where the troops take shipping for the places of their destinations."

Among other means adopted by Knox for, as he termed it, "broaching" the subject was that of giving evidence thereon—among other matters—before a House of Commons Committee which had been appointed "To inquire into the State of the British Fisheries and into the most effectual means for their Improvement and Extension." According to the Third Report of this Committee, bearing date July 14th, 1785, Knox (described therein as of Richmond, Surrey) said that since 1764 he had been fourteen times in Scotland, and on most of his journeys he had paid visits to the coasts to make inquiries as to the state of the country in general and of the fisheries in particular, and to see what could be done to promote their development. In respect to the provision of better means of communication, which he regarded as the fundamental basis of anything they could do to further the welfare either of the Highlands or of the fisheries, he considered that the first and most important step to be taken in this direction was the making between Loch Gilp and Loch Crinan of a canal "by which the people of the Highlands would be brought nearer to Glasgow and the seat of trade and commerce." Ever

since he twice walked over the ground, "many years ago," he had urged the expediency of a canal at this place, and his further visit in 1784, when he made a still closer investigation, had strongly confirmed him in his previous opinion as to the Crinan Canal route being the most eligible one for an improved means of communication, the importance and practical value of which he urged from various points of view. Whilst, also, Watt had reported on a canal having a depth of 7 ft. or 10 ft., Knox recommended that the depth to be adopted should be 12 ft.

In giving their conclusions the Committee said that "some canals" appeared to be necessary for assisting navigation in Scotland, and the "one which seems to be the easiest to be made, would also be of the greatest importance," was that from Loch Gilp to Loch Crinan, "by which a most dangerous and most tedious voyage between the north-western and the more cultivated parts of Scotland would be avoided." In a report presented to them under date May 4th, 1786, the Committee also included the following among their "Resolutions":—

Resolved, That as the opening of a communication between Loch Gilp and Loch Crinan, by a navigable Canal across the peninsula of Cantyre, in Argyleshire, would prevent the necessity of a voyage of more than one hundred miles, in a very dangerous sea, and greatly promote the Fisheries and commerce of the north-western coasts of the island; and as it appears, by actual survey, that the said communication may be effected at a moderate expence; it is, in the opinion of this committee, extremely desirable, that such persons as are willing to perform, at their own cost, a work so useful to the public, should receive all reasonable encouragement,

One may reasonably assume that, in thus giving their approval to the project in question, the Committee must have been greatly influenced by the arguments which John Knox, the retired bookseller but still active philanthropist, had put before them in its favour.

Another scheme strenuously advocated by Knox, and one directly associated with his canal proposals, related to the setting up throughout the Highlands of coastal villages, small towns and harbours in the interests both of the people and of the fisheries in general.

What he especially aimed at in this connection was the offering of some inducement to those who were carrying on a desperate struggle for existence in the more isolated districts of the Northern Highlands to remove, by means of inland navigation, to the low countries where, in habitations located alongside the new or improved waterways, they would be in closer touch with the world and with social, economic and civilizing influences opening out to them prospects they could not hope to obtain under their existing conditions. The new waterways would, more especially, ensure the means by which the wants of the settlers could be supplied in respect alike to their domestic needs and their independent purchase of fishing tackle, etc., placing them, also, in a better position for sending their fish to the markets on the Clyde.

So it was that Knox had much to say on this subject in his "View of the British Empire," where he further entered into details as to plans for the proposed villages, the most desirable situations for them, estimates

of cost, etc. In 1786 he published "Observations on the Northern Fisheries, with a Discourse on the Expediency of establishing Fishing Stations or Small Towns in the Highlands of Scotland and the Hebride Islands"; and thereupon the British Fishery Society, which had already collected £7,000 for the establishment of fishery villages in Scotland according to the plan proposed, commissioned Knox to make "a more extensive journey in the Highlands and Isles than had ever been performed by an individual." The journal he kept on this journey was published by him in 1787 under the title of "A Tour through the Highlands of Scotland and the Hebride Isles in MDCCLXXXVI."

FINANCIAL QUESTIONS.

While the expediency and the practicability of constructing a canal by the Loch Gilp-Loch Crinan route were admitted by all concerned, it was foreseen from the outset that difficulties would be experienced in raising the necessary funds for carrying out the work. Knox himself had confessed that, although the canal would confer an inestimable boon upon the shipping industry, the fishing vessels would be unable to use it if they were required to pay dues and charges on such a scale as would suffice to meet interest on capital expenditure together with cost of upkeep and management. The vessels would simply continue to take the old course round the Mull of Kintyre. In these circumstances it was not to be expected that private investors would be disposed to find all the money that would be wanted, and he proposed that the Government should advance one-third of the requisite capital, the remainder being provided in part by cities and towns (including those on the Forth and Clyde which, on the completion of the Forth and Clyde Canal, would benefit by the through communication by water with the Highlands), and in part by subscriptions from noblemen, gentlemen and others interested.

On the other hand, Dr. Anderson, who was employed by the Government in 1784 to examine the state of the fisheries on the western coasts and islands of North Britain, drew up some "Observations on the Canal to be cut between Loch Gilp and Loch Crinan" for the consideration, apparently, of the British Fisheries Committee, by whom it was appended to their Third Report, mentioned above; and, while suggesting that, if funds could be obtained, the canal should be from 9 ft. to 12 ft. in depth (inasmuch as, if the "Carron Canal" were finished, all the traffic between Leith or the eastern coasts of the island and the Hebrides would pass through the Crinan Canal), he expressed in some detail his view that "it would be much more eligible to have it made as a private undertaking than as a public job." All the same, he thought it would be better if the Government guaranteed a 4 per cent. dividend to those of the subscribers who desired to have such guarantee.

PRIVATE ENTERPRISE.

Some years later a number of influential persons resident or interested in the districts concerned had the idea of themselves undertaking the

construction of a canal by the Crinan route, less for the purposes of profit than in order to provide an improved means of communication which should be of great public advantage, and especially so, as they hoped, in promoting the social and economic welfare of the Western Highlands. In 1792 they employed John Rennie to make a fresh survey, and Rennie reported on a canal which was to have a depth of 13 ft., a bottom width of 48 ft., and a water surface width of 84 ft., on the lower reaches, and a depth of 14 ft., a bottom width of 42 ft., and a water surface width of 84 ft. on the summit level. This summit level would be at an elevation of 63 ft., the rise to be overcome by sixteen locks. In the first instance Rennie reported that the scheme, which he regarded as quite practicable, could be carried out for £63,678; though on revising his estimates he increased the sum total of the probable expenditure to £107,512.

The promoters thought they would be able to raise this amount, and they obtained from Parliament an Act, dated May 8th, 1793, "for making and maintaining a navigable canal from Loch Gilp to Loch Crinan in the Shire of Argyll." In this Act the scheme is spoken of as likely to be "of advantage to trade and general utility." The original subscribers, forming "The Company of Proprietors of the Crinan Canal," consisted of 208 persons, among whom were John, Duke of Argyll, the Marquis of Tweeddale, the Marquis of Lorne, the Earl of Breadalbane, the Provost of the City of Glasgow and the chairman of the Glasgow Chamber of Commerce (incorporated 1783). The authorized capital was £120,000; but, in the event of this amount being found insufficient, the company were empowered to raise a further sum of £30,000 either by subscription or by a mortgage on the undertaking.¹

The work of construction, entrusted to Rennie, was begun the same year (1793), and for a time good progress was made. Financial difficulties, however, soon began to be experienced. It was found that much more capital would be required than had been anticipated, while a number of persons who had undertaken to support the scheme failed to keep their promise. The amount actually subscribed was, in fact, only £98,000. In some "Observations on the Dimensions and Expence of the Crinan Canal, with the Advantages the Commerce of the Western Coast of Scotland and the Places adjacent are likely to derive from it" which

¹ One result of the formation of this company was to supersede action which had been proposed in another direction, as shown by the following statement on p. xxxvi. of Vol. I of *Prize Essays and Transactions of the Highland Society of Scotland* (1799):—

"The practicability and expediency of a navigable communication through the isthmus of Kintyre from Loch Gilp on the east to Loch Crinan on the west was mentioned in a letter to the Society from Lord Salton in November, 1787, and was afterwards frequently brought under its notice by Sir John Clerk of Pennycuik and his uncle, Mr. Clerk of Elden, both zealous in every object of national improvement, particularly in any which relates to the Highlands. On motion of the former, at a general meeting on January 10, 1792, it was recommended to the Committee of Directors 'to consider how far a canal between Loch Gilp and Loch Crinan can be effected; to examine and consider Watt's survey, and to correspond with Mr. Robert Whitworth, or any other able engineer, as to the expence of making another survey, in case the one by Watt is not approved of.'

"But any further proceeding by this Society was rendered unnecessary in consequence of the effectual adoption of the plan for that canal by a Company of subscribers by whom it is now carried on."

John Rennie prepared for the British Fisheries Committee, under date May 12th, 1798, he said it was doubtful if, "owing to bankruptcies, etc.," £10,000 or £12,000 of the subscription would ever be paid at all, and there was the prospect of a deficiency of about £14,000 which the proprietors would have either to borrow or to raise among themselves. "The money," he added, "comes in so slowly that it is impossible to fix a time for the completion of the work."¹

In 1799 a further Act obtained by the company authorized them to increase their capital by £30,000; but the money could not be raised. The resources of private enterprise seemed to have been exhausted, and, as an alternative to abandoning a work regarded as of "considerable national importance," the company applied in the same year to the Barons of the Court of Exchequer in Scotland for an advance of £25,000 on security of the rates and duties of the canal. Parliament sanctioned the loan, but stipulated that the canal should be assigned to the Barons, on mortgage, until the sum borrowed had been repaid, with interest. The work was then proceeded with and the canal was opened for traffic in 1801. Owing, however, to the fact that the funds had run short before the western half of the waterway was begun, this portion was still in an incomplete condition. The channel there was narrow, and some very awkward bends and rocky corners were left. These defects were never properly remedied, and they remained, and still are to-day, a constant source not only of difficulty but of actual danger.

Great expectations were originally formed as to the advantages likely to be derived from the waterway. Nor were these advantages to be confined only to shipping and trading interests and to dwellers in the Highlands and Islands. John Phillips, in his "General History of Inland Navigation" (4th edition, 1803), spoke of the Act of 1793 as "one of the most useful for the fisheries of Scotland ever passed."

By 1805, however, the Company of Proprietors was dealing with a fresh series of troubles. The need for repairs necessitated the closing of the canal from January in that year until June, 1806. This meant a heavy expenditure simultaneously with absence of revenue. The said expenditure, too, was all the heavier because of the great rise in the cost of labour and materials owing to the Napoleonic wars, the experiences of the Caledonian Canal thus being repeated in the case of the Crinan.

FURTHER APPEALS FOR STATE AID.

In the circumstances, and in view of the continued hopelessness of more money being found for the canal by private individuals—the shares of £50 each were, in 1802, £25 below par—a further appeal was made to Parliament for aid in completing "this great national undertaking" in order that the public should not be deprived of "the great advantages which would arise therefrom to commerce, to the fisheries and to the improvement of the Western Islands and the north-west coast of Scot-

¹ See "Further Report on the State of the British Herring Fishery, June 27th, 1798."

land " ; while unless, it was declared, such further aid could be rendered, the money already advanced by the Government would be lost.

An Act passed in 1805 authorized the Treasury to advance £25,000 under the same conditions as before.

Five years later another loan was needed. Serious damage had been done to the canal by the collapse of one of its principal reservoirs, and traffic was stopped from that time until August, 1812. With the authority of Parliament, the Treasury, in 1811, advanced £5,000 towards the cost of completing the repairs.

In 1815 it was reported that, although the canal was then, in several respects, in a better condition than formerly, much still remained to be done, not only to finish it, but to keep it in working condition. The drawbridges were in a dangerous state; many of the lock gates were totally decayed; with two exceptions the whole of them required to be replaced or repaired; there were leakages in the canal banks and in the masonry of the locks; the rock-cutting had left the sides of the canal at the western end in so ragged a state as to injure the vessels which, in a waterway both narrow and crooked, were forced upon the sharp points of the rocks; the principal reservoir was defective, causing the water supply to fail in dry weather, and so on with other troubles, besides. The cost of carrying out the necessary repairs and of at last completing the canal (apart from the clearing off of the Government advances and the settlement of other liabilities), was estimated at £19,207. But the company had no funds available for the purpose, and, at a meeting of the Committee of Management held at Inveraray Castle on September 20th, 1815, a resolution was passed requesting the Duke of Argyll and Lord John Campbell to renew an application they had already made to the Lords of the Treasury for their assistance, " without which it appears evident that the canal cannot be kept open for any length of time."

An additional reason for pressing this application was found in the prospective early opening of the Caledonian Canal, to which the Crinan would serve as a feeder in the transport of traffic between the Clyde and Inverness by what, when both were completed, would be the shortest available route. Each of the two waterways, forming links in the same chain of communication, should complement and add to the revenue of the other, while the Government which was spending so much on the Caledonian might, it was thought, well be disposed to spare a little more for the Crinan in order, if not to finish it, then, at least, to save it from an otherwise inevitable abandonment.

The question of making further advances was referred in 1816 to a Parliamentary Committee by which it was reported that the amount expended on the Crinan Canal down to this time had been £180,000, made up as follows:—Sums raised by subscribers, £98,000; tolls and other revenues, £15,000; advances by the Government, £55,000; borrowed by the company on transferable securities or otherwise, £12,000. As regarded the £19,207 still wanted to complete the canal, it appeared to the Parliamentary Committee that the company would be unable to raise this sum

owing to the fact that the undertaking had been assigned to the Barons of the Court of Exchequer as security for the advances already made by the Government. The Committee, however, being of opinion that great advantages were likely to result to the fisheries of the Western Islands and to the west coast of Scotland from the completion and "sure condition" of the canal, recommended that Parliament should advance the said sum of £19,207, provided that the expenditure thereof should be under the direction of the Commissioners of the Caledonian Canal,¹ the amount to be a debt due to the public from the Company of Proprietors, secured in the same way as before.

Adopting this recommendation, Parliament, in July, 1816, passed an Act authorizing the Treasury to advance £19,400 to the Commissioners of the Caledonian Canal for the purposes of the Crinan Canal, under the conditions stated. Subsequent to the expenditure of this further advance (duly made in 1817), the Commissioners, by desire of the Treasury—which had succeeded to the powers formerly exercised by the Barons of the Exchequer in Scotland—continued their management of the Crinan as well as of the Caledonian Canal, the main reason therefor being that from 1816 onwards there was no one else to take their place.

The expenditure on the canal of the further sum voted by Parliament greatly improved the condition of the waterway for a time, and, with the opening of the Caledonian Canal in 1822, the Crinan started on a period of increased usefulness.

Unfortunately the revenue had, from the first, scarcely sufficed to cover establishment expenses and cost of maintenance, and these conditions still prevailed. The Government had offered to relinquish the debt due to them, provided that the proprietors raised a sum sufficient to put the canal in a proper state of repair and to ensure their not having to apply to Parliament for still more advances; but the company, after making repeated attempts to regain possession on these terms in the interests alike of the public and of their own subscribers, had to abandon the idea owing to a general unwillingness on the part of the Scottish public to put any more money into the venture. Hence it was that, apart from the possibility of securing further help from Parliament, there was no prospect of obtaining the funds necessary for the more important of those repairs, renewals and improvements of which the undertaking continued to be greatly in need. Not only had the canal never been properly completed, but much of the work done was of such inferior quality (owing, partly to the desire of the original builders to carry it through at the least possible expense, and partly to an undue haste resorted to in the interests of revenue) that there were repeated failures of lock masonry, together with other mishaps foreshadowing further heavy expenditure on repairs.

A GOVERNMENT SURVEY.

By 1838 the general conditions had become so serious that the Caledonian Canal Commissioners made an urgent appeal to the Government

¹ See p. 12.

to arrange for a thorough examination of the canal by some eminent engineer. When, therefore, Mr. James Walker, C.E., made in that year his inspection of the Caledonian Canal, he was instructed to report, also, on the condition of the Crinan Canal ; and this he did.

The importance of the Crinan for steam communication was, said Mr. Walker, much less than for sailing-vessels unless the canal and its locks should be enlarged to the same dimensions as the Caledonian Canal, or unless the summit of the Crinan were cut down, thus saving eight locks. The main value of the Crinan from a traffic point of view was in relation to the trade of the Clyde ; but, if kept in an efficient state, the waterway " must be beneficial as a public navigation and as an important arm of the Caledonian Canal." He recommended the carrying out of, at least, some absolutely essential improvements.

This report, as well as the one made by Mr. Walker on the Caledonian Canal, was considered by the Select Committee of 1839, and the view this Committee took of the situation was far from encouraging. No dividend, they said, had yet been paid to the original proprietors of the Crinan Canal, and no interest had yet been received by the Government on the advances they had made. The works were in a dilapidated condition. The depth of water was frequently insufficient, and often did not exceed seven feet. Some parts of the waterway afforded only a very difficult navigation, and there was an absence of many facilities which ought to be provided. The failure of the canal was, however, really due to its originally defective construction and insufficient dimensions, and they entertained great doubts whether any further outlay on it would be advisable—more especially unless the Caledonian Canal should first be put into a condition of efficiency.

It certainly was the case, the Committee went on to say, that on the north-western coast of Scotland, and still more so in the districts in its immediate neighbourhood, the canal conferred benefits which were very considerable ; but as long as the system of management then in force was continued no improvement could be expected to arise from the exertions of those resident proprietors who ought to be most interested in the prosperity of the canal. On the one hand the shareholders, by reason of the Government mortgage, were deprived of all control over the management and would, naturally, provide no money for further improvements ; on the other hand the Commissioners under whose direction the undertaking nominally rested exercised very little, if any, charge over it, and the whole management during nearly twenty years had devolved, apparently, upon the resident engineer, almost without check or control. The Committee proceeded :—

This want of attention to the affairs of the canal is stated to have arisen from an expectation which has prevailed that other arrangements would be made for the management, either by Government taking it into their own hands or by the proprietors resuming possession, on the Government abandoning their mortgage. In the opinion of your Committee nothing can be more objectionable than the position in which the affairs of the canal at present stand, and they see no prospect

of the Government obtaining any return of their advances ; neither is there any ground for expecting that the traffic on the canal will increase under the present management or that its revenue will become sufficient to meet those improvements which are the most obviously requisite to advance the prosperity of the undertaking. Your Committee therefore recommend that any doubt which may exist of the right of the Government to foreclose their mortgage should be removed by a declaratory Act authorizing the Treasury to take such steps for the future support and management of the canal as they may deem advisable, either by postponing the Government security now held, so as to induce private enterprise to embark in its improvement, or by foreclosing the mortgage and absolutely disposing of the property.

Down to this time the total expenditure had amounted to, approximately, £183,000, including the £74,000 advanced by the Government. The cost of the repairs recommended by Mr. Walker and of others recommended by Mr. W. Thompson, the resident engineer, was estimated at £9,000, and the Select Committee of 1839 said of them that they would materially "tend to improve the present line." The repairs were taken in hand shortly afterwards.

STATE OWNERSHIP.

On the reopening of the Caledonian Canal in May, 1847, after the repairs and improvements which had necessitated the stoppage of the traffic thereon for a period of three and a half years, the Caledonian Commissioners were invited to continue their control of the Crinan Canal as well as of the Caledonian. Thereupon they wrote concerning the Crinan Canal in their 42nd annual report, dated June 30th, 1847 :—

The Commissioners trust that measures for placing on a more distinct and satisfactory footing the affairs and management of this undertaking will shortly be taken by the Lords Commissioners of the Treasury, in whose nominee the Canal is legally invested as a security for the repayment of the £74,400 advanced for its completion by the Government.

It has been explained to successive Select Committees of the House of Commons, that the Canal was placed under the charge of the Caledonian Canal Commissioners, solely for the special and temporary purpose of superintending the expenditure of the last grant of £19,400 in 1817, on the performance of which duty the Commissioners were *functi officio*. The expectation, kept up by preferring successive Bills of Parliament, that the original Company of Shareholders might be induced again to claim their property, upon conditions which should insure to the public the maintenance of the navigation, has hitherto operated to check the active interference of all other parties ; but the failure of the very liberal offers by the Government leads to the conclusion that this hope must be abandoned, while the great changes which the last 30 years have introduced into the management of undertakings of this nature, make a thorough revision of the system pursued at the Crinan Canal absolutely necessary. The Commissioners trust that this revision will be made, and that the charge, if remitted to them, will be accompanied by the requisite powers.

An investigation into the methods of conducting the affairs of the Crinan Canal was conducted by the Queen's Remembrancer, acting under the authority of the Treasury, who were thus made more fully acquainted

than they had been before with the unsatisfactory nature of the existing system.

So it was that in the Act "for incorporating the Commissioners of the Caledonian Canal and for vesting the Crinan Canal in the said Commissioners," which became law August 14th, 1848, it was stated, among other things, that the public debt on the Crinan Canal amounted to £74,000, apart from interest; that the revenue scarcely sufficed to defray the cost of maintaining the canal in efficient working order, and that there was no prospect of any augmentation of such revenue except by adjustment of the duties leviable and by the expenditure of large sums of money, considerable repairs still being necessary to render the navigation safe and permanently useful. Having regard to the heavy public debt for which the Company of Proprietors was responsible and the lengthened period which had elapsed since the commencement of such debt, it was thought only just and reasonable that the canal should be at the disposal of her Majesty's Treasury, freed and discharged from all the rights, title, interest, claim and equity of the said company. It was further expedient that the Commissioners of the Caledonian Canal should be incorporated, and it was essential that the Crinan Canal and works should be vested in them (in addition to the Caledonian Canal itself), in order that both navigations might be under the same management. If, however, the Company of Proprietors of the Crinan Canal should at any time within twenty years of the passing of the Act pay or cause to be paid into her Majesty's Treasury the sum of £74,000, with legal interest thereon, together with all such sums as the Commissioners had expended in improving and keeping in repair the canal and works over and above the amount of the tolls and rates, then the canal would revert to the company, and the power of control over it exercised by the Caledonian Canal Commissioners would cease.¹

This Act of 1848 was followed, in 1860, by another under which all powers and provisions of earlier Acts applying to the Caledonian Canal were made equally applicable to the Crinan Canal; while, as already mentioned on page 30, in connection, with the Caledonian Canal, the Commissioners of that undertaking were also authorized to grant or lease the canals, or either of them, for a period not exceeding ninety-nine years, "with or without any annual return or rent therefor," to any person or company under such conditions as might be thought fit and proper by the Commissioners. No person or company was, however, prepared to take over the Crinan Canal, any more than the Caledonian Canal, even on these generous terms; and, inasmuch as the proprietors

¹ One further effect of the passing of this Act was to empower the Caledonian Canal Commissioners to carry into effect any alterations in the canal rates without obtaining the previous assent of the creditors of the undertaking; and the Commissioners availed themselves of this authority in order to reduce the dues chargeable on vessels using the navigation. Inquiry had shown that of the vessels entering or clearing from the Clyde ports during 1847 and 1848 whose destinations and whose dimensions admitted of their taking the route of the Crinan Canal, only about 47 per cent. did so, the remainder proceeding by the circuitous course round the Mull of Kintyre rather than pay what were regarded as the heavy dues for the canal passage.

—who had had practically no power or authority over the Crinan since 1817—failed to raise within the twenty years allowed by the Act of 1848 the sum requisite to enable them to regain possession, the canal, by default thereof, definitely became State property in 1868, remaining under the control of the Caledonian Canal Commissioners as before.

DESCRIPTION OF THE CANAL.

Bearing in mind the important services it renders, or should be in a position to render, as a short means of communication between the mainland of Scotland, the Highlands and the Islands, the Crinan Canal might be regarded in the light of a Scottish Panama Canal, with the voyage round the Mull of Kintyre as a small-scale reproduction of that round Cape Horn.

In the one case, also, as in the other, the canal extends from sea to sea, the Crinan serving to connect Loch Fyne and the Firth of Clyde with the Sound of Jura and the Firth of Lorne, thus forming, so far as its capacity permits, an ocean highway. Extending from Ardrishaig, on the east, to Crinan, on the west, it has a total length of $8\frac{3}{4}$ miles, with a summit level of 64 ft. above mean sea level. There are three reaches, known respectively as the Ardrishaig, or east, reach, the summit reach, and the Crinan, or west, reach.

The east reach is nearly four miles long, is 32 ft. above sea level (mean tide level) and connects with the sea at Ardrishaig by means of four locks and three basins.

The summit reach, 1,114 yards long and 64 ft. above sea level, connects with the east reach by four locks and three basins at Cairnbaan, and with the west reach by five locks and four basins at Dunardry.

The west reach is about three miles long, is 18 ft. above sea level and connects with the sea at Crinan by two locks and one basin.

There are thus no fewer than fifteen locks in the short distance of nine miles, the difference in the number of those by which the summit reach is approached from the east and the west respectively being accounted for by the difference in the height of the tides in Loch Fyne and the Sound of Jura. In regard, also, to these locks, it will be seen from the longitudinal section on page 65, that a steamer on her way to the west has to ascend 32 ft. from the east reach to the summit and then come down again to the west reach level in a distance of only 2,220 yards, or, say, a mile and a quarter. It is evident, therefore, that, when the canal was being made, an additional cutting of this length, and of only 32 ft. in depth, would have converted the east reach into the summit; dispensed with eight of the fifteen locks; given a much better summit with a much more reliable water-supply, and effected a very great and permanent saving in the cost of working and maintenance. Not only, however, was this not done, but another "penny-wise pound-foolish" economy was made in building the nine summit locks of rubble masonry instead of the dressed ashlar used at Ardrishaig, with the result that the

maintenance of the summit locks (like that of the west reach) became a continual source of trouble and expense.

Then the locks constitute a hindrance to navigation, not only in themselves, by reason of the loss of time in passing through them, but, more especially, in the case of thirteen out of the total of fifteen, because of their very small dimensions. The thirteen have each a length of 96 ft. from centre to centre of the gates and a width of 24 ft., while the two others, those, namely, at the Crinan end, were, for some reason not now to be accounted for, given an additional length of 12 ft. and an additional width of 2 ft. The largest vessel which can navigate the canal is, approximately, one that is 88 ft. in length, 20 ft. beam, with a draught of water of 9 ft. 6 in., and having a maximum cargo capacity of from 160 to 170 tons deadweight.

In regard to these limitations in the transport capacity of the canal, one must bear in mind that, when construction was begun in 1793, the Crinan was designed to accommodate no more than small sailing vessels. Steam navigation was then unknown. The world had to wait until January, 1812, for the new era in navigation inaugurated in this country by Henry Bell's steamer, the *Comet*.¹ To-day the vessels which pass through the canal consist almost exclusively of steamers; yet these vessels are still controlled, and the sea communications of the Western Highlands and Islands are still handicapped, by the conditions of close on one hundred and thirty years ago.

Another serious disadvantage of the locks arises from the high cost of working, repairing and maintaining them, especially having regard to the imperfections of their original construction.

The utility of the canal is further restricted by the conditions of the west reach for a distance of about two and a quarter miles.

Mention has already been made (p. 56) of the awkward bends and rocky corners left in this reach; but grave dangers to shipping also result both from the narrow and tortuous character of the channel and from the inadequate depth. At one point the width of the channel is only 29 ft. 6 in., while the water-space between passing vessels and the rocky bottom is, in some places, no more than a few inches—a condition which threatens them with serious injury in the event of stones, not necessarily of any great dimensions, falling into the water from the cutting through the rock alongside. Such, indeed, are the dangers of the passage along this western reach that when, in 1878, the navigation was stopped for sixteen weeks owing to lack of water, there were cleared out no fewer than fifteen tons of propellers which had been knocked off boats by the rocky corners. Then, also, since 1885 the engineer and manager of the canal has had to raise eleven small steamers which had sunk owing to

¹ It may be of interest to recall the fact that the *Comet*, launched from the yard of John Wood, of Port Glasgow, went through the Crinan Canal on her first trip to the Highlands in 1813. She was 42 ft. long, 11 ft. in breadth, with 5½ ft. draught of water. Her engine was one of 3 horse-power, and was equal to a speed of about five miles per hour. Her usual runs were from Glasgow to Helensburgh and thence across the Clyde to Greenock.

their having come in contact with the rock. Others have been reduced to a sinking condition from the same cause. Hundreds of cases of minor damage have also occurred.

Under all conditions, and at all times, navigation of the western reach is a matter calling for much caution. During the prevalence of high winds it has to be suspended altogether.

Still another hindrance to navigation arises from the fact that the sea-lock at Ardrishaig is available only at certain states of the tide, namely, from three hours before until three hours after high water. Vessels may thus be detained for a period of six hours.

The canal has about eight miles of artificial bank; it is crossed by seven swing bridges, and there are nine storage reservoirs, equal to a superficial area of about 200 acres, for water supply, the extent of the available gathering ground being limited by the height of the summit reach. The breadth of the canal in the best constructed portion is about 80 ft. at the surface and about 40 ft. at the bottom; but in many places, especially in the west reach, the channel is very much smaller than this, and in some places is too narrow for boats to pass each other.

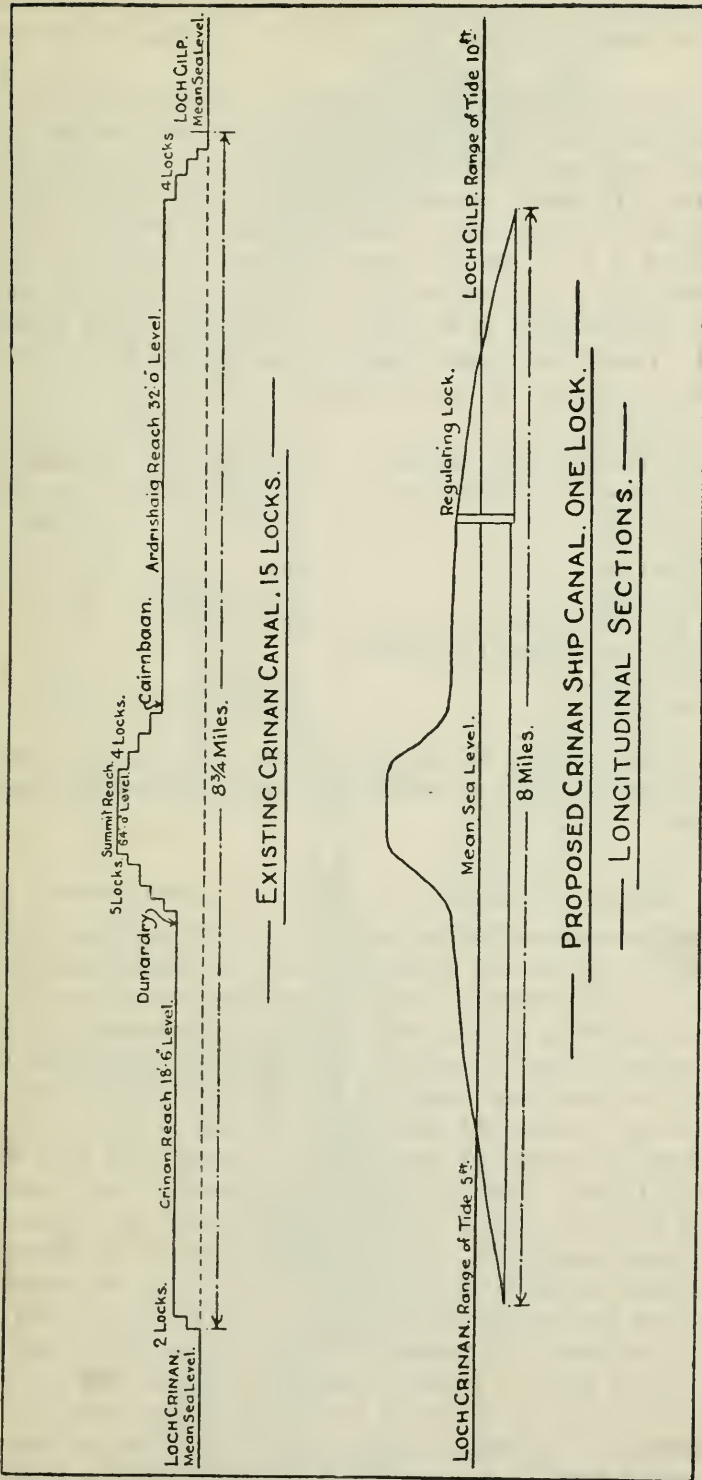
PROPOSED SHIP CANAL.

In 1892 Captain Donald Dewar, owner and master of the steamship *Jura*, originally designed and constructed for traffic on the Crinan, brought before the Argyll County Council a proposal that representations should be made to the Government urging upon them the necessity for "a new ship canal in lieu of the present dangerous waterway," and the County Council decided so to do. Four years later, further action on the part of Captain Dewar was the means of a petition signed by eleven owners and charterers of Glasgow herring steamers being addressed to the Caledonian Canal Commissioners praying that they would bring pressure on the Government in the same direction and on the ground that a new ship canal was necessary to put the Highland fishing industry on a proper basis. These efforts, however, remained abortive.

At the end of 1905, and following on the continuous complaints which had been made as to the antiquated and dangerous condition of the canal, Mr. L. John Groves, who had succeeded in 1885 to the position of resident engineer and manager, under the Caledonian Canal Commissioners, presented to that body a memorandum setting out the principal defects and disadvantages of the Crinan Canal, and offering recommendations as to the means by which, in his judgment, they could best be remedied.

As a proof of the insufficient size of the canal, Mr. Groves mentioned that only three of the steamers then trading regularly with the Highlands were small enough to pass through it, while very few of the fish-carrying steamers, and only a small proportion of the steam yachts visiting the Highlands, were able to go that way.

In view of the probability of heavy expenditure being soon required, and having regard to the gravity of the defects he enumerated, Mr. Groves considered it would be only prudent to inquire whether money could not



be laid out to better advantage than in renewing what was out of date ; and he accordingly outlined a proposal for an enlarged and improved canal.

This proposal was thought so well of by the Commissioners that in 1906 they had a detailed survey made and plans and estimate prepared by Mr. Groves in association with Messrs. Crouch and Hogg, Civil Engineers of Glasgow. The survey included the putting down of trial bores, and the result was to show that a fresh-water canal with two locks and a summit level of 11 ft. could be constructed for—at that time—£745,000, while alternatively a sea-water canal, with one regulating lock (necessary owing to the difference in the tides at either end), could be made for £796,000. How the sea-water-canal proposal compared with the existing canal may be shown by the following statement :—

PARTICULARS.	EXISTING CANAL.	PROPOSED CANAL.
Carrying capacity of cargo steamer .	150 tons.	Over 1,600 tons.
Carrying capacity of passenger steamer	270 passengers	1,200 passengers
Length of canal	9 miles.	8 miles.
Depth of water	9½ ft.	20 ft.
Number of locks	15.	1.
Lock dimensions	96 ft. × 24 ft.	350 ft. × 55 ft.
Length of artificial bank.	Eight miles.	None.
Sharp turns, rocky corners, dangerous points	Numerous.	None.
Delay for tide	Six hours in 12.	None.

An immediate revenue of £20,000 from the improved canal was estimated, while the cost of working and maintenance was put at £6,000 per annum.

ROYAL COMMISSION ON CANALS AND WATERWAYS.

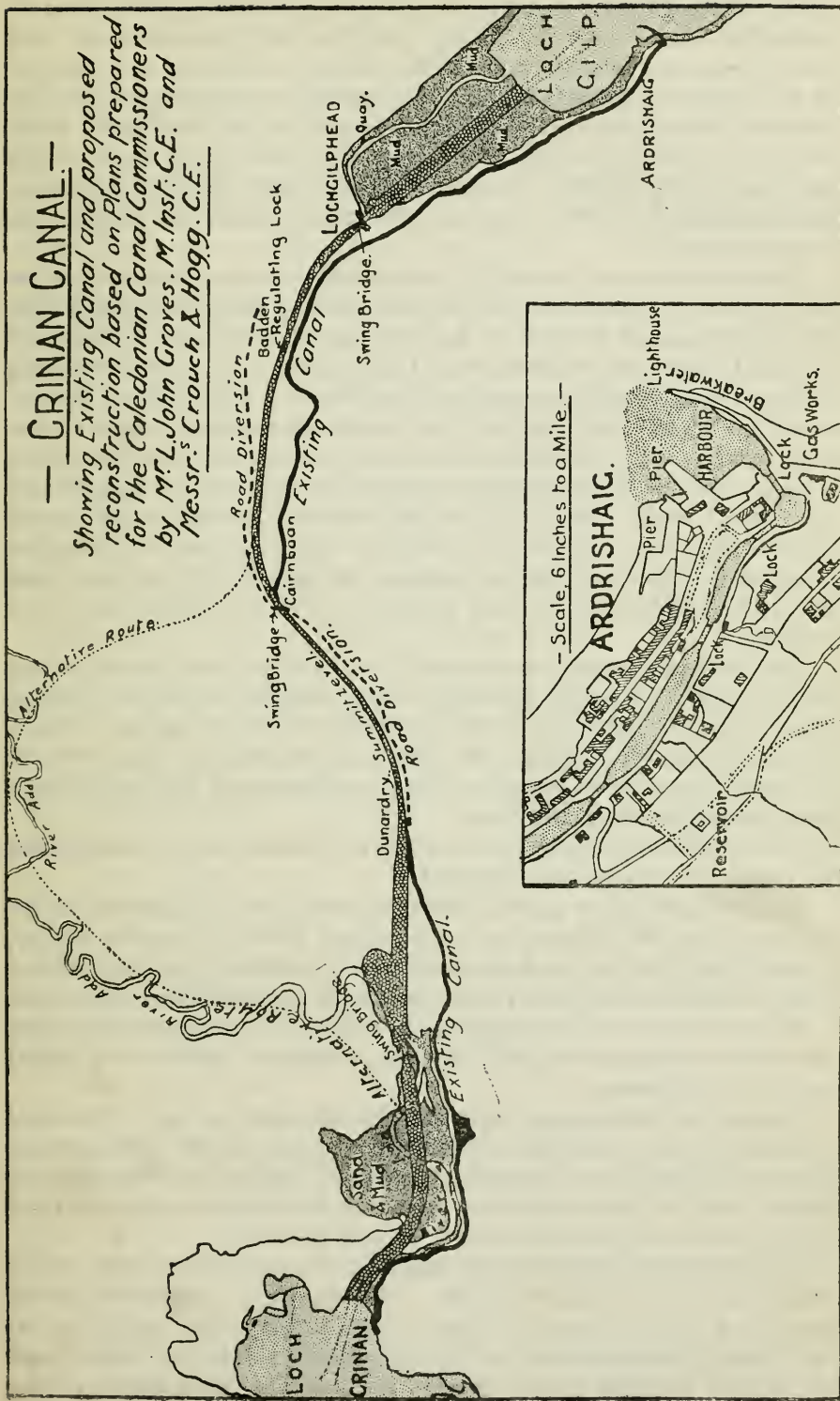
During the course of their sittings (1906-9), the members of the Royal Commission on Canals and Waterways made an inquiry into the history, condition and prospects of the Crinan, in addition to other canals, and the survey and report in question were duly put before them.

The evidence given in regard to the Crinan brought out the fact that the traffic then consisted mainly of coal and general merchandise going north from the Clyde to the West Highlands, and of slates, sand, granite, timber, kelp, live stock and farm produce brought south from the Highlands to the Clyde. There was, also, a large passenger and tourist traffic, estimated at nearly 30,000 persons a year, though 75 per cent. of the revenue came from goods. Very few sailing-vessels, as compared with small steamers carrying cargo in bulk, went through the canal, which, however, was also used by fishing boats, yachts and vessels in ballast.

Various witnesses who referred to the condition of the canal spoke of it as "out of date"; "quite obsolete"; "practically worn out"; "hardly fit to be called a canal at all"; "a waterway that had outlived its usefulness"; "too narrow, shallow and tortuous for the larger vessels of the present date," and "capable of being used only by small craft or

— CRINAN CANAL.—

Showing Existing Canal and proposed reconstruction based on Plans prepared for the Caledonian Canal Commissioners by Mr. L. John Groves, M. Inst. C.E. and Messrs. Crouch & Hogg, C.E.



vessels specially built to traverse it and the Forth and Clyde Canal." In addition to the dangers arising from the rocky corners in the west reach, leaks were very frequent there. About 100 had had to be stopped in the course of twenty years. The sea-locks at either end and the masonry of the locks on the summit were not in good condition. What with the risks and the delays in using the canal, many small vessels preferred, in fine weather, to take the passage round the Mull of Kintyre, notwithstanding all that had once been said about its dangers and inconvenience.

Representatives of the fishing trade said it was necessary that the herring-steamers should be able to pass with all possible dispatch from one fishing ground to another, as for example, from Loch Fyne to the Firth of Lorne ; but the locks on the Crinan Canal were too small to allow of the majority of the boats going through them. Of the fifteen herring-steamers then in Loch Fyne, only two could take advantage of the Crinan Canal route. The remainder lost about twenty hours on the return voyage round the Mull of Kintyre, and, also, used up at least an additional ten tons of coal. Taking all the fish carriers running in and out of Glasgow, only about 20 per cent. could use the canal, and even these had to allow for the time lost in passing through the fifteen locks and for the delay of six hours that might result from missing the tide at Ardrishaig.

Mr. Duncan Lamont was especially emphatic as to the disadvantages of the canal. "I have," he said, "been engaged in the fish trade of Glasgow on my own account during the last twenty-five years. I know the Crinan Canal fairly well. My opinion in reference to it as it exists at present is that it is of absolutely no use whatever to the fresh fish or fresh herring trade of Glasgow."

Yet it had been to a large extent in the interests of the fisheries that the canal was originally projected !

On the question of tourist traffic, Captain John Williamson, of the Turbine Steamers, Ltd., and an authority on this branch of the subject, declared that if the proposed ship canal were constructed, a great passenger traffic would be created between the Clyde and the West Highlands. "The loss of time and the expense," he added, "in getting to Crinan by the present route is strangling the great passenger traffic which should now be in existence."

Among the disadvantages attributed to the canal, owing to its defects and shortcomings, were that it kept down competition for the trade of the Western Highlands and Islands, encouraged high rates of transport to districts many of which were very poor, and discouraged their export and import trade and the development of local industries.

On the financial aspects of the question, it was estimated that merely to put the canal into the condition it was originally designed to assume would cost from £100,000 to £120,000, while this outlay would not do away with the fifteen locks—a "useless ladder" which the vessels would still require to climb up and down. Reduction in the number of locks

would probably raise the expenditure to £200,000 or £250,000, and even then the results would not be satisfactory. Better far, it was argued, would it be to build a new canal.

The witnesses generally assumed that, if a new canal were made, the work would have to be done at the cost, or, at least, at the risk of the State. Too much money had, they said, already been sunk in the undertaking by private investors for any more to be looked for in that direction. On the other hand it was thought that the prospective increase in receipts, due to the greater amount of traffic carried and to the expansion of trade and transport in the districts concerned, was a matter that should be taken into account. It was represented, for example, that an improved canal, leading to lower rates, would be followed by a great expansion in the fishing industry, extended over a wider area among the Western Islands; to a greater tourist traffic, and to the use of the canal by yachts already visiting the west coast of Scotland in considerable numbers in the summer and autumn, as well as by trading vessels of considerable tonnage plying between the Clyde ports and the west and north of Scotland and the Baltic, a further effect of this increased traffic being to permit of the canal dues being kept moderately low. There were also expectations of developments in local industries, more especially as regarded the setting up on the Highland coasts of works to be run by water power, as in the case of those already established at Kinlochleven.

As an alternative to a new Crinan Canal, suggestions were made for the construction of a ship canal between West Loch Tarbert and East Loch Tarbert, on the same peninsula. Various advantages were claimed for this route over the Crinan route; but the Royal Commission pointed to the fact that (among other considerations), "on emerging from West Loch Tarbert during a 'sou'-wester,' vessels which might prefer the canal to a voyage round the Mull of Kintyre would still encounter the stormy seas which, passing to the east and west of Gigha, often continue to be very rough for ten or twelve sea-miles north of that island. And the tourist bound for Oban would be exposed to these troubled waters, which are avoided by the Crinan route." It was further suggested that "the tourist traffic, the fishing boats and some of the goods traffic might continue to use the present Crinan Canal, if means were found for its continued upkeep, in preference to the Tarbert route, thus diminishing the tolls for the latter." There would certainly appear to be no justification for having two canals so close to one another, while the Royal Commission admitted that, for various reasons, the Tarbert route did not impress them favourably. Since they thus gave expression to their views concerning the Tarbert route, practically nothing more has been heard of it.

In summing up the general situation the Commissioners said, in their Final Report:—

A strong case has been made out for an improved communication across the Mull of Kintyre, with only two locks, at the two entrances, for much larger vessels than the small craft which at present navigate the Crinan Canal, capable indeed

of taking the largest ships that ply between the Western Islands and Glasgow, with a reasonable margin for probable future developments in their dimensions. . . .

As regards the public importance of either route, by Crinan or by Tarbert, the case presented was not so strong as to convince the Commission that such a considerable increase of traffic would be obtained as to insure a direct return on the capital outlay. It cannot be foretold with certainty to what extent the trade which is now carried round the Mull of Kintyre would by preference be taken by the shorter and less stormy route. But, from the point of view of the poor populations of the Western Highlands and Islands—and especially of the congested districts enumerated by Mr. Macgregor in his evidence—it is worthy of the consideration of the Government whether the contribution of a certain amount of public money, without the certainty of a direct return on the outlay, might not be justified. If it can be fairly expected that the supplies needed by the congested districts would reach them at a reduced cost, and that the trade of those districts would reach Glasgow more rapidly—if the fisheries also were likely to be benefitted in the way suggested by some of the witnesses—and if the increase of tourists would develop local prosperity, a case would be made out which would, in our opinion, justify a liberal grant of public money to meet such smaller contributions or guarantees as might be obtained locally and from traders.

The Crinan Canal is worn out, and in need of extensive repairs and alterations, if it is to continue in its present form. The upkeep of the canal is dependent on a small income, insufficient for these repairs and works, and—according to the precedents in the case both of the Crinan Canal and the Caledonian Canal—repairs and improvements would have to be met out of moneys voted by Parliament. It may fairly be argued that such a vote might, with far greater advantage, be applied to the new and improved canal, on one or other of the routes, and that a larger vote for a more useful new canal would be preferable to the smaller vote that is otherwise inevitable for the repair and improvement of a small defective waterway which such minor measures cannot convert into a satisfactory means of transit.

But the Commission are of opinion that, in a case of this kind for the development of local trade and local tourist traffic, your Majesty's Government might fairly make it a condition of the grant of public money that some of the counties and the trading interests (including those of Glasgow) concerned in the future use of this route should give practical expression to their interest in its development either by local contribution or by guarantees. The Commission have done their best, throughout our inquiry into this subject, to put forward this suggestion, and it has not been unfavourably received by some of the witnesses. Little or nothing could be expected from some of the poorer districts affected. Other districts could not contribute from the rates, unless special powers were bestowed upon them by Parliament. Some which have a "common good" would be able to make a moderate contribution. In any case, traders at least should be invited to combine to make some offer.

FURTHER GOVERNMENT SURVEY.

Realizing as they must have done, not only from these representations of the Royal Commission but from the oft-repeated statements of the Caledonian Canal Commission, that the Crinan Canal was, indeed, "worn out" and "in need of extensive repairs and alterations," the Treasury gave instructions in 1910 to Messrs. Sir John Wolfe Barry and Partners to report on the repairs and other works which would be necessary if the Crinan Canal was to "continue to be used for its present purposes." There was here, apparently, no suggestion of a new canal—merely such a

renovation of the existing waterway as would keep it in working order. The desired report was duly presented to the Treasury in February, 1911, and the cost of reinstating the canal as originally constructed was estimated therein at £31,650; though the Commissioners of the Caledonian Canal, in commenting on the estimate in their own report for 1917, observed :—

This sum allowed for no improvement, such as the removal of rocky corners, which have always been difficult and dangerous to the navigation, or for the deepening of the sea lock at Ardrishaig. If these works were undertaken it was estimated that an extra sum of £19,770 would be required.

This gave a total of over £51,000, on the basis of pre-war figures, while the said repairs and other works would still have left the canal with many of its old shortcomings, including its "ladder" of locks to reach, and to descend from, the summit level.

VIEWES OF THE TREASURY.

In March, 1911, the Commissioners of the Caledonian Canal decided that "owing to the defective condition of the Crinan Canal and the need for extensive repairs and improvements," an application should be made, through the Treasury, to the Development Commissioners for a grant to allow of the work of re-construction being carried out.

This application was duly made, and a reply was received to the effect that the works recommended by the Caledonian Canal Commissioners were on so important a scale that they could be considered only in connection with a general scheme of canal development. The Treasury, it was further intimated, were of opinion that it would not be practicable for the Development Commissioners to make a grant from the Development Fund, and had referred the question to the Secretary for Scotland. This they had done on the ground that the maintenance of the canal was a matter of "purely local concern," and one that affected "a very limited class indeed, viz., that class of traders which desires to avoid rounding the Mull of Kintyre." The Treasury considered "it would not be justifiable to call on the general taxpayer to pay the whole capital cost of the repairs," but that some local body, such as the Clyde Trust or the County Council of Argyll, should be invited to bear a portion of the cost.

The Caledonian Canal Commissioners did not agree with the Treasury in the view that the Crinan Canal was a matter of only local concern, and they were of opinion that it was, rather, one in which the whole population of the West of Scotland was indirectly interested; but they cordially concurred in the reference of the question to the Secretary for Scotland. A meeting of persons interested in the canal, convened by Lord Pentland, was held at Glasgow in 1912, and at this meeting it was decided to form a committee to make inquiries as to the possibility of obtaining local support on the lines suggested by the Treasury. These inquiries were,

presumably, unsatisfactory, since no further reference is made to them in the official reports. Nor did the Treasury take action on the estimates prepared for them by Messrs. Sir John Wolfe Barry and Partners.

VIEWS OF LOCAL AUTHORITIES.

On October 9th, 1912, the County Council of Argyll convened a meeting at Oban of representatives of that body and of various other public authorities, together with persons interested in the Highlands generally. A resolution was passed drawing the attention of the Government, "as owners of the Crinan Canal," to various facts and contentions in regard to the Crinan Canal, representing, among other things, "that the construction of a Crinan Ship Canal, available at all states of tide, and capable of passing expeditiously the largest steamer trading to the Highlands, would be of very great benefit to the district by cheapening and accelerating communication with Clyde ports," and "that the bringing of the entire district into closer touch with, and eighty-five miles nearer to, its southern market, would do much to arrest the serious depopulation now in progress and greatly help to develop new industries." The resolution concluded:—

In view of the facts above stated, this meeting ventures respectfully to point out to the Government that, should the Crinan Canal be allowed to remain any longer more than a century out of date, they will be obstructing progress and withholding from a wide and necessitous district an important aid to prosperity.

VIEWS OF THE CRINAN CANAL ENGINEER.

In January, 1913, Mr. Groves contributed to "The Scottish Bankers' Magazine" an article on "The Proposed Crinan Ship Canal" in which he gave details concerning the advantages that might be expected to result therefrom. In the course of this article he said:—

To illustrate the inadequacy of existing transport facilities, it is needless to refer to the unfortunate position of some of the outlying islands, and only necessary to take two points on one of the main lines of communication, and consider how a journey between Ardrishaig and Fort William (a distance of 68 miles by water) can be accomplished. For eight months out of the twelve there is no steamer connection at all, and the only feasible route is by steamer from Ardrishaig to Gourock, thence to Glasgow by train, and next day by train to Fort William. That is to say, for two-thirds of the year it is necessary to make a journey of 200 miles, and stop a night in an hotel, to reach a place 68 miles distant. During the four summer months the outward journey, occupying eight hours, can be made by steamer in one day, but not so the return. In the summer season of the year of grace 1912, the writer, having reached Fort William by steamer in a little over the time mentioned, found that only on *one* day in the week was it possible to make the return journey of 68 miles without having to spend a night at Oban, although twenty-five years ago it could, during the season, be done every week-day.

The Ship Canal would be an effective remedy for this state of affairs, for it would enable swift steamers to make the journey from the Clyde (Fairlie, or Wemyss Bay), direct, and without change, to Oban in four-and-a-half hours, and to Fort William in six-and-a-half hours. At present the passenger from Wemyss Bay to

Oban makes use of *three* steamers (involving two changes) and of a service of horse-drawn luggage vans between Ardrishaig and Crinan. If he proceeds to Fort William, he has another change, and travels by a fourth steamer; and when he finds that it has taken ten hours to cover 108 miles, and that the cost of the "variety entertainment" is inversely as the speed thereof, he may find consolation in the reflection that four steamers cannot be run as cheaply as one, and that bunker coals on the Clyde, and bunker coals at Oban, have different values.

Mr. Groves went on to show that the questions at issue involved much more than the personal convenience of travellers. On this point he declared that—

The depopulation of rural districts, and of the Highlands in particular, is little short of a national calamity; but is there any wonder that people emigrate and industry languishes when, to a naturally isolated situation, is added the disadvantage of costly and inadequate transport?

AVOIDING COLLAPSE.

All these various efforts, however, were unavailing, while the deterioration of this State-owned canal was more or less continuous, the repairs carried out, by means of such limited resources as an average revenue (under pre-war conditions) of only about £6,000 a year might leave available, having done little more than avoid—if not, indeed, merely postpone—that more or less complete collapse with which the undertaking seemed to be threatened.

Thus, in their report for the year ending April 30th, 1910, the Caledonian Canal Commissioners referred to the extensive repairs done to the Crinan Canal in May, 1908, involving a stoppage of the navigation for fourteen days, and said that this work represented "the merest fraction of what is required. It will," they added, "probably be necessary to resort to more frequent interruptions of the traffic in future, and there is not the slightest prospect of any reduction in expenditure unless the canal is improved and reconstructed." In 1913 they said:—"The repairs executed to the locks during the short stoppages of 1909-11 have so far proved effective; but the engineer states in his report that 'the extent of these repairs is altogether insignificant in comparison with what would be necessary to put the canal and all its locks into proper condition, and their effect is merely to postpone for a little longer a compulsory stoppage for very extensive repair and reconstruction.'" In 1915 the report made was to the effect that the unsatisfactory state of the canal continued to develop, and that more than the usual amount of damage had been caused to vessels by the rocky corners, sides and bottom of the Crinan reach. Motor vessels of the type recently introduced had been the chief sufferers. In 1916 the Commissioners reported a large decrease in the receipts due to conditions resulting from the war, though the Crinan had shared in advances made by the Treasury to assist the finances of the two canals and to meet the deficits which had arisen. The report further stated that, owing to the depletion of staff by enlistment or otherwise, no repairs not immediately necessary were carried out during the year,

so that the unsatisfactory state of the canal had not in any way been improved.

In their report for the year ending April 30th, 1917, the Commissioners once more took up the old story, saying :—

Numerous representations have reached the Commissioners as to the inadequacy of the existing canal and the need for the construction of an improved and modernised canal in substitution for it. It is represented that such a canal would be of great benefit to the trade and agriculture of the west coast generally and of the Islands in particular.

The Commissioners have in former reports repeatedly drawn attention to the present condition of the canal. The various works, constructed more than 100 years ago, are in as good condition as can be expected, having regard to their age and to the limited resources at the command of the Commissioners for repairs and replacements. The ordinary work of maintenance has been necessarily curtailed owing to the conditions of labour and finance, caused by the war, and the Commissioners think it necessary to record their opinion that extensive repairs will have to be effected in the near future if the canal is to be maintained even in its present condition, and that there is a constant and increasing risk of a serious breakdown which will involve the closing of the canal.

The Commissioners have at their disposal no funds which would be available for any extensive renewals or repairs, still less for the construction of the improved canal referred to above. . . .

Without entering into the arguments for or against the construction of a new canal, which were given at length in evidence before the Royal Commission, the Commissioners desire to place on record their opinion that the whole matter should be taken into consideration without undue delay, and they suggest that his Majesty's Government should set on foot an inquiry to determine the following points :—

1.—Whether sufficient advantages to the trade of the country and to the population of the Islands and the West Coast of Scotland can be anticipated from the construction of a new canal, or from improvements in the existing canal, to justify the expenditure involved, and, if so, from what source such expenditure should be met, and under what conditions.

2.—Whether any considerable expenditure of public money should be incurred in the event of any repairs or renewals becoming necessary to the existing canal beyond what can be afforded from the resources of the Commissioners.

The physical conditions of the canal remained about the same in 1917-18, though, on account of the depletion of the staff and the abnormal increase in the price of materials, maintenance work was reduced to the lowest limit consistent with safety—a fact which contributed still further to the accumulation of work in arrear.

WAR-TIME TRAFFIC.

War-time conditions had their inevitable effect, also, on the traffic. A high percentage of the small cargo boats which usually trade through the canal had been requisitioned by the Admiralty; the coal traffic was affected by high prices, while the canal was closed to passenger traffic from quite an early stage in the war. The decline in the number of passages through the canal since 1913 is shown by the following table :—

PASSAGES.	YEAR ENDING APRIL 30.							
	1913	1914	1915	1916	1917	1918	1919	1920
Cargo-carrying Steamers and Sailing Vessels .	1,417	1,341	1,305	878	1,091	798	816	1,116
Fishing Boats and Yachts	399	400	346	116	92	38	140	261
Passenger Steamers .	245	248	170	59	2	2	7	112
Total .	2,061	1,989	1,821	1,053	1,185	838	963	1,489

On the other hand, as against the decline in traffic there is to be put the fact that the Crinan Canal, in spite of all its shortcomings and limitations, was able to render useful public service in the prosecution of the war or otherwise, the total number of passages on Admiralty account from the outbreak of hostilities to April 30th, 1920, having been 249. The comparatively small proportions of these figures—which represent less than one-twentieth of the passages O.H.M.S. on the Caledonian Canal during the same period—were entirely due to the inadequate size of the locks and waterway. Even the trawlers and drifters so extensively employed by the Admiralty during the war were nearly all too large for the Crinan Canal. The waterway was, nevertheless, used regularly by all naval craft able to pass along it, or in regard to which it was desired to avoid the wide *détour* round the Mull of Kintyre—a *détour* which in war-time was still greater than before owing to the defensive measures taken to prevent enemy vessels from gaining access to the Forth of Clyde through the passages between the Mull of Kintyre, Islay and the Irish coast.

RENEWED EFFORTS.

One result of the war was to establish beyond any possibility of doubt the much greater service which the Crinan Canal might have rendered both to the Navy and to the mercantile marine during that period of strain and of national danger if only it had been widened, deepened and reconstructed generally according to the plans prepared in 1907. So it was that renewed efforts were now made to secure the achievement of this design.

Under date June, 1917, Colonel E. D. Malcolm, of Poltalloch, Kilmartin, Argyll, one of the Caledonian Canal Commissioners, issued a circular letter, extending to four pages of closely-printed foolscap, in which he made a strong appeal for help in the attempt to induce the House of Commons to authorize the construction of an improved Crinan Canal. In giving the history of the present canal and stating the case for a new one he said :—

As might be expected, such of the original construction as is below sea level, or otherwise inaccessible, has very much deteriorated in the course of 116 years' use. Indeed *age* alone would almost account for its present moribund condition, which is such that a failure may occur at any moment; and if it does the blame will rest entirely on the Government's disinclination to accept the responsibility attaching to ownership. The Government has been informed, time after time, not only of the state of the existing works, but also of the urgent need for improvement and enlargement; yet nothing has been done, and they still allow the best route between the Clyde and the north (not only of Scotland but of Europe) to be blocked for modern traffic (other than very small vessels) by the insufficient size and the antiquated design of their 116-year-old canal. . . . That a work of public utility, owned by Government, should have been allowed to become over a century out of date indicates a neglect it is impossible to justify.

Colonel Malcolm dealt with the possible advantages of a Crinan Ship Canal as applying (1) to the Highlands, (2) to the Clyde, (3) to national defence, (4) to the Caledonian Canal and (5) to general shipping.

In regard to the Highlands, the enormous length of coast line, as compared with area, made an adequate railway service impossible and rendered it necessary that the bulk of the traffic should go by sea. Therefore, Colonel Malcolm submitted, the importance of bringing the whole of the Highlands and Islands eighty-five miles nearer to their market by means of a sheltered passage which would facilitate the shipping of live stock and make the outlook for the crofter or small landholder brighter could hardly be over-estimated.

The ship canal would, also, greatly facilitate the despatch of fresh fish to the Glasgow market.

On the question of national defence, Colonel Malcolm declared that if only the proposed improvement scheme had been carried out before the war opened, the Crinan Canal might have been used not only by small auxiliary craft—such as the patrol boats, mine-sweepers and carriers of naval stores which accounted for the passages actually made on Government service—but, also, by many of the smaller class of war vessels. A Crinan Ship Canal would, also, provide the Clyde estuary with another outlet. It would make this additional outlet available for all traffic that its size could accommodate, and, therefore, Colonel Malcolm continued, "I claim for it a strategic as well as a commercial value. It could easily be made proof against enemy submarines, and would be quite a convenient 'side door' for the craft that hunt them, and, also a short and safe route for any 'lame ducks' going to the Clyde for repair."

Under the enlargement scheme, the Crinan Canal would no longer be handicapped in dealing with traffic to and from the Caledonian Canal.

Finally, in Colonel Malcolm's opinion, the saving of an exposed passage and of eighty-five miles in distance would, provided the dues were reasonable, result in every ship of suitable dimensions whose destination involved the rounding of the Mull of Kintyre taking the ship canal route in preference.

Then, also, the County Council of Argyll decided, on December 13th, 1917, again to urge upon the Government the necessity for the con-

struction of a new Crinan Ship Canal. It reaffirmed the views expressed at the Oban meeting in 1912, and declared that the case in favour of reconstruction had become even stronger for the following reasons among others :—

(a) That, after the lapse of five years, the necessity for action has become all the more urgent in respect that the time is now appreciably nearer when the works of the existing canal must, by reason of age and extended use, cease to be of any further service ; and

(b) That the experience of the last three years has proved beyond doubt that, in war time, an additional access from the sea to the Clyde estuary, available at all hours for craft of reasonably large dimensions, would be of the utmost value, and that the proposed ship canal would provide such an access.

Copies of these minutes, of those passed at the Oban meeting and of Colonel Malcolm's letter were afterwards forwarded to the Secretary of the Admiralty by the County Clerk of Argyll, and a reply was received in which it was stated :—"The Admiralty would have no objection to the construction of this canal in the future."

In April, 1919, the Scottish Divisional Council for Civil Demobilisation and Resettlement, of which Lord Strathclyde is the chairman, considered a memorandum which had been drawn up for them on the proposed reconstruction alike of the Caledonian Canal and of the Crinan Canal. In regard to the latter, it was strongly urged by the Council that the waterway should be so extended and developed as to become a ship canal in the real sense of the word, in order that it should be available at all states of the tide for large vessels, which would thereby be enabled to obviate a long circuitous voyage. The Council felt that the construction of such a ship canal would be of very great advantage by cheapening transport and bringing the whole West Highland region nearer to its markets.

A Committee appointed by the Secretary for Scotland in February, 1918, to consider and report upon the subject of Rural Transport in Scotland, presented their report in 1919, and therein they dealt with the Crinan Canal, among other subjects. Having referred to the alternative proposals for (1) the repairing and improving of the existing canal and (2) the construction of a new ship canal at a cost, they said, under the conditions at that date, of not less than £1,000,000, they went on to say :—

The question to be decided is whether the advantages to be gained from the adoption of one or other of the courses recommended are sufficient to justify the expenditure involved in either case, the money for which would, apparently, have to be found from public funds, there being no indication that any portion of the amount required would be contributed from local sources.

We feel that the construction of a ship canal would undoubtedly be a decided advantage to the trade between the Clyde and the lower Western Isles, and, to a certain extent, with the districts further north, the circumstances of which, however, it must be recognized have been altered since the date of construction of the Crinan Canal by the building of railways to Oban, Mallaig and Kyle. A large question involved is the opening up of a shorter route for the larger vessels carrying on the trade between the Clyde and the North Sea and Baltic by utilization of the Crinan and Caledonian Canals, and the possibility of these canals being used for strategic purposes by the Navy in time of war. These, however, are questions which

do not come within the sphere of our remit, and we recommend, therefore, that effect should be given to the suggestion made by the Commissioners of the Caledonian Canal in 1917 that the Government should set on foot an inquiry into the questions affecting the future maintenance of the Crinan Canal, consideration of which, we understand, was postponed until after the termination of the war, and we suggest that the Caledonian Canal should be included in the remit.

TRANSFER TO THE MINISTRY OF TRANSPORT.

How, under the Ministry of Transport Act, which became law August 15th, 1919, the Crinan Canal, as well as the Caledonian Canal, was transferred from the Caledonian Canal Commissioners to the Ministry of Transport, and how increases in the rates, tolls and charges on both canals, made by the Rates Advisory Committee and approved by the Minister of Transport, came into operation on August 2nd, 1920, has already been told on pp. 36-7. The new tariff, as it affected the Crinan, represented an average increase of income for the canal to the extent of about 45 per cent. on the basis of the traffic in 1914; though, having regard to the increased cost of operation and of materials, it held out no hope of doing more than balance the increased expenditure.

A MINISTRY OF TRANSPORT CRINAN CANAL COMMITTEE.

In March, 1921, the Minister of Transport appointed, under Section 23 of the Ministry of Transport Act, 1919, a Committee which had for its terms of reference—

(1) To consider whether the advantage accruing to the trade of the country or otherwise and to the population of the Islands and the West Coast of Scotland from the existence of a Canal, justify expenditure on :

- (a) The mere upkeep of the existing Canal, or
- (b) The improvement of the existing Canal, and, if so, for the accommodation of what size of vessel.

(2) To consider from what sources the expenditure on either of the above alternatives should be met if, in the opinion of the Committee, the Canal should not be allowed to become derelict.

(3) In arriving at their conclusion on terms (1) and (2) above, the Committee should take into consideration the commercial prospects of the Canal in relation to the expenditure involved by the alternative policies and should be guided by the amount of local support as evidenced by local financial contribution.

QUESTION OF NEW CANAL EXCLUDED FROM INQUIRY.

It will be noticed that in these terms of reference there is no suggestion that the Committee thus appointed should inquire into the question as to the construction of a new canal, to take the place of the existing and avowedly inadequate one, although Ministerial statements made in the House of Commons had certainly led to the assumption that this apparently vital consideration in the controversy which had arisen would be included in any investigation that might take place. On December 15th, 1919, Mr. Neal, replying on behalf of the Minister of Transport to a question put by Mr. G. Murray (St. Rollox, Glasgow), had said that a detailed survey of the Crinan Canal was being undertaken by the Ministry

of Transport in order that a decision might be arrived at as to which, if any, of the following policies should be adopted :—" To repair the present canal, to improve and extend it, *or to construct a new canal.*" When, however, the announcement was published that a committee of inquiry had been appointed by the Minister of Transport, it was found that the provision of a new canal was not to come into consideration at all, and that the committee were, instead, to express their views as to whether or not the existing canal should be allowed to become derelict !

UNAVAILING PROTESTS.

A strong protest was made by the Argyll County Council, which, for nearly thirty years had supported the proposal for the construction of a new canal, had repeatedly made representations to Government Departments in favour thereof, had been in the best position to realize the disadvantages experienced by the West and North-West Highlands and Islands as the result of the inadequacy of their available communications, and had arrived at the firm conclusion that the only scheme deserving of consideration or further investigation was one that would relate to the provision of an entirely new ship canal.

Early in July, 1919, when the question as to the future of the Crinan Canal was under consideration in view of the proposed establishment of a Ministry of Ways and Communication, it was represented in a letter addressed to the Board of Trade by direction of the Argyll County Council that—

To repair the existing canal without improving it, and thus to perpetuate what is admittedly a century out of date, would evidently only be a waste of public money.

To effect the small improvement that would result from reducing the number of locks from fifteen to seven, from slightly increasing their length, but otherwise leaving their present insufficient dimensions unaltered, and from making access independent of the tide, would doubtless be of considerable advantage to the canal itself by reducing the cost of maintenance and increasing its earning capacity ; but any material benefit to the Highlands at large would be inappreciable.

Concerning the views of shipowners, the letter went on to say that when these were ascertained some years ago they were, with one exception, unanimous and to this effect :—" If the shipowners found that it paid them to use the canal instead of making the long and exposed passage round the Mull of Kintyre, they would most certainly use the canal ; but otherwise they would not." The fact of there being one exception raised the question as to the continuance of the existing monopoly of the Highland passenger steamer trade ; but the letter went on to say :—

The people who have a really vital interest are those in every part of the Highlands whose homes and whose industries would be brought by the ship canal eighty-five miles nearer the Clyde and given the advantage of efficient modern transport at a reasonable cost.

The County Council, therefore, in advocating the ship canal, is endeavouring to benefit the entire population of the West and North-West Highlands and Islands.

Similar representations were afterwards made to the Ministry of Transport, and when the terms of reference of the Committee appointed by the Minister were made known, great disappointment was expressed by the County Council that what was regarded by them as an essential feature of any inquiry to be held into the subject should be excluded therefrom.

The Minister of Transport replied that, having regard to the definite pronouncement made in the House of Commons on December 9th, 1920, by Mr. Chamberlain, then Chancellor of the Exchequer, as to the policy of the Government in respect to public expenditure, he had been unable to give any instruction to the Committee that they should take into consideration the construction of a new canal.

Mr. Chamberlain's statement on the occasion in question is thus recorded in the official reports :—

Whilst recognizing that there are many reforms that are in themselves desirable in order to improve conditions in the United Kingdom, the Cabinet, having regard to the exceptionally heavy taxation which is the inevitable consequence of the war, the high cost of material, the trade reaction that has set in, and the emergency measures required to mitigate the hardships of unemployment, consider that to the extent that such reforms involve further burdens upon the Exchequer or the rates, the time is not opportune for initiating them or putting them in operation. It is an instruction, therefore, to all spending departments that, except with fresh Cabinet authority, schemes involving expenditure not yet in operation are to remain in abeyance.

It might, however, be suggested that the inclusion in the terms of reference of an *inquiry* into the ultimate desirability of providing a new canal in place of the old one would not in itself have necessarily involved the casting of further burdens upon the Exchequer or the rates, and that, when the improvement of the existing waterway was being taken into consideration, such eventual substitution of a modern ship canal for one built to serve the transport conditions of a century ago became an essential factor in the situation since, if such substitution were to be made when circumstances allowed, at some later period, it might be found possible to modify accordingly the improvements to be carried out at the present date. In this case it is conceivable that a saving in expenditure might have been effected if the inquiry had been conducted along the lines contemplated in December, 1919. Nor, in any case, would such an inquiry, made from this point of view, apart from "initiating" reforms or "putting them in operation," and pledging the Government or the spending departments to nothing, have been really in conflict with Mr. Chamberlain's pronouncement of Government policy.

In the circumstances the Committee had to rule out as irrelevant much that the witnesses examined by them wished to say as to the desirability of a new waterway ; although, at the request of Lieutenant-Colonel T. O. Lloyd, who gave evidence on behalf of the Argyll County Council, of which body he is Vice-Convenor, they reproduced in their report a statement he was allowed to read to them on the subject. Such statement set forth the attitude which the County Council had con-

sistently adopted since 1892 in regard to the construction of a new ship canal, and proceeded :—

On hearing that your remit eliminated the possibility of our being allowed to press for a new waterway, I requested, in the absence of the Convener, the County Clerk to address a letter to the Ministry urging that you should also hear evidence on what the County Council consider to be the only means of ensuring national facilities on up-to-date lines for inter-communication on the West Coast of Britain. I also urged that as, in our opinion, the canal is in no sense a local undertaking but a national one, you should not be hampered in arriving at your conclusion on evidence submitted by consideration of the amount of local financial contributions. But the Minister, in reply, regretted that he is unable to enlarge the terms of reference in the manner suggested or to withdraw the limiting directions in paragraph 3. We must, therefore, bow to this decision, and confine our evidence within the prescribed limits. We, however, deeply regret that the scope of your inquiries has been thus narrowed.

Among the other witnesses examined were representatives of the Corporation of Glasgow, the Oban Town Council, the Lochgilphead Town Council, the Parish Council of South Knapdale, the Highlands Reconstruction Association, the National Farmers' Union of Scotland, the Clyde Steamship Owners' Association and the British Aluminium Company, Ltd. The report of the Committee, dated July 15th, 1921, and, with reports and statements of engineers, extending to thirty-six pages, was not issued to the public until January, 1922.

THE COMMITTEE'S FINDINGS.

The Committee said in their report that they were much impressed throughout their inquiry by the unanimity with which the witnesses strongly deprecated any idea of allowing the canal to become derelict, and they themselves endorsed the view thus expressed. The question remaining for their consideration was, therefore, as to the nature and extent of the improvements which should be carried out.

On this point they reported that since 1911 the only repairs and renewals effected had been those of the most urgent character, there being, consequently, considerable repairs to be overtaken. Specifying those that were urgently necessary, they said that the estimated cost of this work—which could be spread over two years—would, at the prices then prevailing, be £14,700 ; but these repairs would only suffice to keep the canal in a reasonable state for three years at the most.

Considerable repairs and renewals, including reduction of the more serious rocky corners, would then require to be undertaken, and the cost of these further improvements, on the basis of prices as in July, 1921, was put at £192,000. The cost of lowering the existing summit level to that of the east reach (31 ft.), thus reducing the number of locks from fifteen to seven and effecting a saving of about £1,800 per annum in working and maintenance, was estimated at £196,000 ; but, if these larger works were undertaken, others required on the summit level, and allowed for to the extent of £92,000 in the £192,000 estimate, would not be necessary.

As regards the limit of improvement of which the present canal is physically and economically capable, the Committee were advised that this was represented by a scheme which, in addition to the lowering of the summit level, would include (1) the construction of a new sea lock at Ardrishaig ; (2) the improvement and deepening of the east reach ; (3) the abandonment of the western reach in favour of a new channel from Dunardry to Loch Crinan, and (4) the construction at Dunardry of two locks to reduce the water level of 31 ft., to sea level, the navigation thus becoming tidal seaward of the second or sea lock. These alterations would allow for the passage of a vessel of 125 ft. over-all, 21 ft. beam, 10 ft. 6 in. draught, and carrying about 250 tons. The cost of this further scheme, on the same basis as before, was estimated at between £680,000 and £700,000.

FINANCIAL QUESTIONS.

In regard to the second term of their reference—that, namely, as to the sources from which the expenditure either on upkeep or on improvement should be met if they were of opinion that the canal should not be allowed to become derelict—the Committee had come to the conclusion that, even under the most favourable conditions which could reasonably be expected, the revenue would not be likely to cover the charges involved in the capital cost of the proposed new works, while little or nothing was to be expected from local contributions owing, more especially, to what had been represented to them as the already heavy burden of the rates paid in the areas concerned. “No other source, therefore, remains,” they went on to say, “but that of the Exchequer ; and, being satisfied of the essential need of the waterway to the population of the Islands and the West Coast of Scotland, in our considered opinion it is to this source that they are justly entitled to look.”

Throughout the inquiry it had been strongly urged from all sides that the matter should be regarded from a national and not from a local standpoint ; and, in recommending the Minister of Transport to take this view, the Committee invited his attention to the following observations in the report of the Rural Transport (Scotland) Committee, they themselves expressing their entire concurrence therein :—

We take the broad view that there is a national duty to provide every community with reasonably convenient means of communication. The fact that people have settled in isolated districts implies no fault on their part ; with limited facilities they are endeavouring to utilize the resources of land and sea, and in this they are giving effect to national policy and are entitled to claim the utmost assistance the State can afford. In considering what assistance is possible, it would be too narrow a view to look merely for a direct pecuniary return on the capital expended. The indirect return is important—the increased production and better production of wealth, and, more than these, the growth of intelligence, efficiency and contentment in the population. We press this view the more strongly as it accords with the national aspiration that, wherever capacity exists, there should also be given opportunity for its fullest development.

THE CASE FOR A CRINAN SHIP CANAL.

In the construction of a new ship canal to take the place of the existing Crinan Canal is to be found the key to such a development of the social, industrial and economic conditions of the Western Highlands and Islands of Scotland as would in itself justify the expenditure involved, apart from any question as to the exact extent to which the traffic receipts would cover working expenses, maintenance, and interest charges on capital expenditure ; though even in these directions the outlook would appear to be more promising than might be supposed.

From the south of Scotland the railway connections with the west coast are those (1) to Oban and Ballachulish, and (2) to Mallaig, via Fort William, with, from Inverness, on the north-east, the Highland Railway branch to Kyle of Lochalsh. These railways have served a most useful purpose ; but, apart from these lines, and from what can be offered in the way of road services, the coastal districts in the Western Highlands, including places of considerable population scattered along the shores of the numerous sea lochs, are dependent on transport by sea ; and this is, of course, still more the case with regard to the Islands.

As it happens, also, the position in respect to sea communications is even worse to-day than it was prior to 1881, when the railway to Oban was opened. Down to that time there was a bi-weekly service of steamers, winter as well as summer, between Glasgow and Inverness, the smaller of the vessels engaged therein going through the Crinan Canal and then through the Caledonian Canal, while the larger, unable to pass through the Crinan, went round the Mull of Kintyre and so on to the Caledonian Canal. These steamers were of great advantage to the numerous communities they served along the line of route ; but the boats capable of going through the Crinan Canal carried so small a cargo, on account of their restriction in size, that they became unremunerative and were withdrawn, while the large boats had no occasion either to deliver or to receive consignments when making the long *détour* round the Mull of Kintyre which formed so considerable a proportion of their voyage. Their prospects, also, were naturally not improved by the opening of the railway to Oban. So they became more and more irregular in their running, and at the present time there is no through cargo-steamer service between Glasgow and Inverness.

The result of these conditions is that a real hardship is suffered by the populations concerned. The passage round the Mull of Kintyre, though, of course, not so dangerous for steamships as for sailing-ships, remains an effectual barrier to a regular, adequate and remunerative service of passenger and cargo steamers, and the Crinan Canal, while offering a sheltered passage shorter by eighty-five miles, has never yet been completed even according to the designs of its original promoters, whose plans were made before steamships had come into existence. Begun in 1793, a waterway providing for traffic which must necessarily be mainly sea-borne, and the maintenance and efficiency of which are matters

of vital importance to the welfare of so many communities on the west coast of Scotland, offers no greater facilities to-day than it did when the *Comet* passed through in 1813, and is still hampered by an antiquated construction and a long list of drawbacks and disadvantages which make it more than a century out of date.

UNTHINKABLE !

Any suggestion that the Government might allow to become derelict a State-owned sea-to-sea canal which, in spite of its limitations, still constitutes so important a link in our net-work of national communications and, from 1860 to 1914, at least, was able to show a surplus revenue after meeting all maintenance charges, should be unthinkable. It is, indeed, difficult to conceive how such an idea could have been put forward by a Ministry created for the express purpose of "improving the means of, and the facilities for, locomotion and transport." True it is that the Ministry, following on the report of the Committee appointed by them, is now practically bound to do something to prevent the canal from *becoming* derelict, as it assuredly will do unless it receives at least a certain amount of early attention ; but, apart from the repairs spoken of by the Committee as then urgently necessary, the question arises as to whether, instead of expending a substantial sum on those further improvements which, according to the Committee's report, should, or might, be taken in hand subsequently, it would not be better to go further and ensure the construction of a new and really up-to-date waterway. The capacity of the present Crinan Canal and the maximum of the improvements of which, according to the information given to the Ministry of Transport Committee, it is "physically and economically capable" may be shown thus :—

	PRESENT CAPACITY.	POSSIBLE ENLARGEMENTS.
Length of vessel	88 ft.	125 ft.
Beam " "	20 ft.	21 ft.
Draught " "	9 ft. 6 in.	10 ft. 6 in.
Cargo capacity	160 to 170 tons.	250 tons.

A WASTE OF PUBLIC MONEY.

The cost of carrying out a scheme ensuring only such comparatively insignificant improvements as these was estimated at, approximately, £700,000, and it is, surely, worth considering whether it would not be more prudent, and eventually more economical, to apply this amount towards the cost of building a new canal available under all conditions of the tide for the passing of vessels having a cargo capacity of over 1,600 tons, as provided for in the proposed ship-canal scheme. An outlay of £700,000 on an existing waterway having so many defects and shortcomings may well be looked upon as little short of a waste of public money, and the Royal Commission on Canals and Waterways were fully warranted in their suggestion that a larger vote for a more useful new canal would be

preferable to the smaller vote otherwise inevitable for the repair and improvement of a canal which could not be converted thereby into a satisfactory means of transit.

ENCOURAGEMENT OF SHIPPING.

Not only would a new ship canal, constructed on the lines proposed, allow of the passing of vessels having ten times the capacity of those using the present canal, but the time taken in going through, whatever the state of the tide, should be little more than an hour, as against eight hours required for even a fair-weather passage round the Mull of Kintyre, and five hours for the normal passing through the present canal plus a possible detention of up to six hours at Ardrishaig on account of the tide.

This combination of time-saving and increased capacity should certainly be an inducement to shipping in general to take the short and sheltered route in preference to the long and exposed one—provided that the charges were not on such a scale as to be prohibitive ; and the amount of shipping to which this inducement would be offered is not inconsiderable. Statistics collected in 1919 at the suggestion of the Board of Trade showed that from Clyde ports alone over 1,000,000 tons of shipping traded to or from, or via, the west and north of Scotland, the figures being—from Glasgow, 641,000 tons ; Greenock, 253,000 tons ; Ardrossan, 80,000 tons, and Ayr, 32,000 tons.

Encouragement would further be given to the re-starting of the bi-weekly cargo boats between Glasgow and Inverness, passing, under the new conditions, through the Crinan Canal, and serving all intermediate points. Alternatively, or supplementary thereto, there is a suggestion that a daily express steamer service might be run between Glasgow and Fort William, or Glasgow and Oban, whence, in the latter case, subsidiary services could be run to and from the more isolated districts, linking them up one with another and all of them with the Clyde. Incidentally, also, there should thus be introduced a greater degree of competition in shipping along the west coast of Scotland than would seem to be practicable under existing conditions. Lower transport rates are confidently expected to result from increased transport facilities.

TOURIST AND EXCURSION TRAFFIC.

Another anticipation is that a new ship canal, of the type recommended, would give a great impetus to tourist traffic, conferring much advantage alike on the visitors who would be expected to flock there in far larger numbers than at present and, also, on the various eligible places along the west coast north of the Crinan where holiday resorts could be set up as a relief or an alternative to what are apt to become in the summer months the congested areas of Clydeside. Great as are the attractions of the Western Highlands in the way of picturesque scenery, historical associations and romantic traditions, tourist traffic thereto has been greatly discouraged by the tedious delays due to the need for passing through so antiquated a waterway as the existing Crinan Canal ; whereas

if pleasure seekers or holiday makers could be guaranteed through services from Glasgow in large and comfortable steamers which would make the passage of a new Crinan Canal in one hour, or thereabouts, the whole position would be changed. A circular tour from, say, Glasgow via the Clyde, the Crinan Canal and the Caledonian Canal to Inverness,—the steamer journey being made all the way in sheltered waters—returning by train to Glasgow, or *vice versâ*, with power to break the journey at any point of interest *en route*, should become one of the most popular in the British Isles.

Nor would Glasgow's workers fail to appreciate the opportunity of making day excursions by water to Oban and back, via an improved Crinan Canal. The steamer *Queen Alexandra* might take an hour and a quarter longer to get to Oban from the Clyde than to Inveraray, and a long day would be involved if one started from the Broomielaw; but, if, instead, the Glasgow tripper went by train to Wemyss Bay or to Fairlie, and joined the steamer there, returning in the same way, the time occupied would be materially shortened, while the scenery between Crinan and Oban is certainly finer than that between Ardrishaig and Inveraray. Prior to the war the day excursion to Oban by steamer and back by rail was often done. This, however, was a very long business on account of the delays in getting through the Crinan; but under the improved conditions as proposed, the trip would be far more attractive.

Under all these circumstances, tourist and excursion traffic should become a most hopeful source of revenue for the new canal, apart from the advantages arising from the increased travelling facilities opened up to health-seekers and holiday-makers.

IMPROVEMENT OF FISHERIES.

In another direction, one might anticipate that the provision of a Crinan Ship Canal would encourage industries and production of every kind throughout the entire area, more or less, of the Western Highlands and Islands.

There should, more particularly, be a great improvement in the general conditions of the fisheries off the West Coast of Scotland.

At present the fishing areas west of Crinan are neglected because of the impossibility of transporting the catch in good condition to Glasgow. Most of the fish-carrying steamers are too large for the existing canal, and, owing to the delays in the passage of so many locks and of the difficult portions of the navigation, and, also, to the frequent detention for tide at Ardrishaig, even the smaller steamers are precluded from using the canal for the transport of fresh fish to Glasgow.

Consequently, except for fish caught on the east side of the Kintyre peninsula, Glasgow and the Clyde coast resorts have to depend on supplies brought mainly from Aberdeen and the east coast by rail, the Atlantic fishing grounds, to which they are nearest, not being available.

A further result of these conditions is that the local fishermen and crofters west of the Crinan Canal have no market beyond their own

district, and no encouragement to extend their efforts when that market has been supplied.

With an up-to-date Crinan Ship Canal, the situation would be entirely changed. Not only would the largest fish-carrying steamer be able to pass expeditiously and deliver its cargo in the Clyde in good condition, but the largest type of fishing steamer could do the same with its catch. Concurrently therewith, the good fishing grounds around the various western Islands could be made to contribute their proper share to the fish supplies of Glasgow and the populous districts by which it is surrounded.

DEVELOPMENT OF WATER POWER.

A new Crinan Canal would also aid to a substantial degree in the development of water power on the west coast and along the Great Glen of Scotland.

By the existing Crinan Canal the British Aluminium Company, Ltd., deal with about 12,000 tons of goods annually for or from their works at Foyers and Kinlochleven, but very few of the vessels using the canal can take cargo in excess of about 120 tons, whereas at Kinlochleven vessels coming by the Mull of Kintyre are able to bring full cargoes of from 1,000 to 1,500 tons to the piers at the end of the approach channel dredged by the company in Loch Leven to enable them to utilize the west of Scotland sea route for their main traffic inwards and outwards. The average carrying capacity, however, of vessels calling at Kinlochleven is between 200 and 300 tons. In addition to the raw material brought in, and the manufactured material sent out, by sea, other traffic due to the setting up of the works—such as contractors' material and commodities for the townships created to provide for the workpeople employed—is also dealt with by way of sea carriage, via the west coast, from Glasgow and the Clyde ports. Then, too, Kinlochleven receives goods from, or forwards goods to, Larne Harbour, Irish ports north of Belfast, and the Mersey and Bristol Channel ports, and it trades to a certain extent with the east coast and Scandinavian ports, via the north of Scotland; though here, of course, the question of the Crinan Canal does not arise.

It is considered that a Crinan Ship Canal on which reasonable rates were charged would be used by practically all the shipping between, on the one hand, Glasgow and the Clyde ports and, on the other, Kinlochleven and Foyers, the inducement thereto being found in the fact that the ordinary 200 to 300-ton boats would effect a saving in time of about seven hours as compared with the passage round the Mull of Kintyre, plus a possible delay of—as experience has shown—up to twelve or more hours on account of bad weather, this being apart from the risks involved under like conditions; while for vessels able to use the canal there is still that question as to the possible detention at Ardrishaig for any length of time up to six hours on account of the tide. About 50 per cent. of the traffic between Kinlochleven and the English and Irish ports mentioned would be expected to use the canal, and especially so if it allowed of the passage of vessels carrying up to about 1,500 tons of cargo.

All together, the British Aluminium Company estimate that, if a Crinan Ship Canal of the proposed dimensions were constructed, the quantity of goods for or from their Kinlochleven works that would pass through it would probably amount to over 30,000 tons per annum, while the carrying out of their further power scheme for the erection of factories on a large scale at Fort William might ultimately increase their traffic through the canal to at least 90,000 tons per annum.

In addition to the prospects foreshadowed in these directions, there is the fact that, of the 183,500 h.p. in the nine Scottish water-power schemes spoken of on p. 47 as having been surveyed but not yet developed, fully 130,000 h.p. would, if used in the districts of origin, be served by sea carriage from the south-west via the Crinan Canal, should this waterway be so improved that it would be capable of taking the traffic.

It will thus be seen that, from the point of view of the development of water-power in the Highlands—as distinct from other considerations—the construction of a new ship canal by the Crinan route is a matter of much greater importance and urgency than a reconstruction on improved lines, of the Caledonian Canal itself.

NATIONAL CONSIDERATIONS.

On the financial aspects of the questions involved, it will have been noticed that the Ministry of Transport Committee were directed in their terms of reference that even in regard to expenditure on the alternative measures of “mere upkeep” or “improvement” of the existing canal they were to be guided by the amount of local support likely to be obtainable. If this principle were to prevail it would, presumably, apply still more in the event of the ship-canal scheme being seriously entertained by the Government or the Ministry of Transport.

There is, however, justification for the view that a Crinan Ship Canal would deserve to be regarded as much more than of merely local interest, and that a sea-to-sea waterway, serving no one special port, district, town or city, but capable of taking the largest ships that ply between the Western Islands and the Firth of Clyde, would merit consideration from the standpoint of those national interests which are to be associated with any practical and desirable project that may contribute to the already long-delayed development of the Highlands and Islands of Scotland.

That the scheme is, indeed, both practicable and desirable has been affirmed alike by the Royal Commission on Canals and Waterways, the Rural Transport (Scotland) Committee, the Caledonian Canal Commissioners, the Argyll County Council and other public bodies, while, without having a definitely strategical purpose in view, the new canal would also be a means of communication for a much larger type of Admiralty vessels than those which, as shown on p. 75, were able to use it during the course of the Great War. Its utility from the point of view of the country in general would thus be still further increased. Nor, if national reconstruction is to be taken seriously in hand, could a better starting-point well be found than the Highlands of Scotland, where,

with much that is waiting development, and with the continuance of strong Scottish claims upon the country, more is wanted in the way of improved communication, whether by land or by water, than in probably any other section of Great Britain.

Having regard to the general position as here stated, it would certainly be too narrow a view if the provision of this exceptionally desirable new link in the country's waterway communications had to depend either on the amount of local support which could be obtained or upon the question as to whether or not there would be a direct pecuniary return on the capital outlay.

It has been seen that the original canal was projected by noblemen and others who were influenced by a desire, not for personal gain, but to ensure the realization of a project they regarded as certain to be of great public advantage; and they patriotically persevered in their design until, after spending no less than £108,000 upon it, the Company of Proprietors were, not unnaturally, indisposed to provide still further funds out of their own pocket. On the other hand, Highlanders now almost crippled by taxation (as could be readily shown, if it were necessary to go into figures), feel that they simply cannot undertake still heavier burdens, however great their sympathy with the objects sought to be attained.

It is probable that, if a canal begun so long ago by patriots who were pioneers in such work as this, were faced by great social and economic changes at a troubled period of our history, and could not be expected to foresee and provide for, in advance, the needs of another hundred years, had really been allowed to fall derelict when private enterprise could do no more, action would, years ago, under the inspiration of what was being done in other parts of the world, have been taken to construct a really efficient sea-to-sea canal between the Firth of Clyde and the Firth of Lorne. But the Government of the day undertook the continued maintenance of the canal, and the very fact that it has been, and still is, so maintained—though without any increase in its original facilities—may be a reason why the private enterprise of a later period has not attempted to provide, more or less alongside, the up-to-date substitute which is now so much needed. In this way there is really a two-fold responsibility devolving upon the State, and national considerations must, for these reasons also, necessarily remain paramount in the situation which has arisen.

FINANCIAL PROSPECTS.

Passing on to the further question as to the prospective financial results of a new ship-canal undertaking, if it were carried out, the facts and suggestions already offered concerning the traffic which such a waterway might, and should, in the circumstances of the case, be able to secure may suggest that even as regards a direct return there ought to be the prospect of a fair revenue; while if one added thereto the indirect return, whether in actual money, increased population, expansion of

industries, improvement in social conditions, and other advantages not coming into consideration on a commercial balance sheet, there might well be an eventual total gain—if not for the Treasury, then, at least, for the country—which would compensate abundantly for the comparatively small expenditure involved.

A NEW COMMITTEE.

What, however, is here suggested is, not that the Government should at once pledge themselves to undertake the building of a new canal, but that, whilst carrying out those minor repairs which the Crinan Canal Committee spoke of as urgently necessary in order to ensure the maintenance of the existing waterway (and these, it is understood, are being taken in hand), there should, before anything is done in regard to the further series of improvements recommended, be another inquiry—this time into that question as to an up-to-date ship canal which was expressly withheld from consideration on the previous occasion. The appointment of a new Committee for this specific purpose would be non-committal so far as the Government were concerned, while the terms of reference need be no more than—“To consider whether or not, instead of expending more money on the existing Crinan Canal, it is desirable and expedient that a new ship canal should, when the national finances permit, be constructed in its place.”

PART II.—THE FORTH AND CLYDE NAVIGATION.

CHAPTER III.

ORIGIN AND CONSTRUCTION.

FOR the earliest proposal that there should be constructed between the Firth of Forth and the Firth of Clyde a navigable waterway which would permit of sea-going vessels passing direct between the east and west coasts of Scotland, without having to make the passage by the north-about route, we have to go back to the times of Charles II, who occupied the throne from 1660 to 1685.

There is here a suggestion of somewhat ancient history ; but the fact might be recalled in this connection that the earliest plans for the establishment of that navigable waterway between the North Sea and the Baltic which eventually led to the building of the Kaiser Wilhelm Canal, made available for the largest war ships only a month or two before Germany brought about, in 1914, the World's Greatest War, date from the fourteenth century. Between the sixteenth and the nineteenth centuries no fewer than sixteen different schemes relating to a North Sea-Baltic Canal came under discussion, and nine of these were projected between 1863 and 1881.

Whilst the reign of Charles II has been described as the worst in English history, the fact must be admitted that that monarch did show a remarkable degree of foresight and activity in his efforts to secure the improvement of our national communications. When John Ogilby, Cosmographer Royal, re-issued, in 1699, under the title of "The Traveller's Guide," the text (apart from the plates), of his earlier work, "Britannia : a Geographical and Historical Description of the Roads of England and Wales" (1675), he wrote in the Preface :—

This Description of England was undertaken by the Express Command of King Charles II, and it was at his Expence that Mr. Ogilby with great exactness performed an Actual Survey and Mensuration by the Wheel of all the Principal Roads of England.

According to John Campbell's "Political Survey of Britain" (1774), Charles II, who is there spoken of as "very intelligent in and attentive to things of this nature," had surveys made of the depth of the Thames, the bed of which was found to have risen 4 ft. since the Restoration. It was, also, in his reign that an Act "for rendering the Medway navigable through the counties of Kent and Sussex" was passed, and that two separate schemes—one of them by Andrew Yarranton—were proposed for connecting the Thames and the Severn ; while it was to Charles that, in 1670, Francis Mathew, who had failed to get a sympathetic hearing

from Oliver Cromwell, dedicated his scheme for a "Mediterranean Passage by Water for Billanders of Thirty Tun between Bristol and London."

So, in all these circumstances, it is not surprising to find that Charles II was (as far as available records show), the original pioneer of a Mid-Scotland Ship Canal, to be effected by means of a waterway connection between the Forth and the Clyde. For this conclusion we have the authority of, among others, John Knox, who says in his "View of the British Empire" (1785):—"An object of such general utility did not escape the notice of Charles II, who was a great promoter of every design which had the success of trade and navigation in view." Charles, we are further told by the same writer, proposed that there should be cut between the two rivers a passage "for transports and small ships of war"—a statement which shows that strategical considerations were paramount even at this early date; but the estimated cost, namely, £500,000, was regarded as a sum "far beyond the ability of his reign," and the design was not then proceeded with any further.

THE UNION BETWEEN ENGLAND AND SCOTLAND.

It was subsequently revived, however, as a result of the political and economic changes due to the Union effected between England and Scotland in 1707.

Scottish merchants, shipowners, manufacturers and farmers had, down to this time, a long list of grievances against the English Government in respect to the prohibitions, the "burdensome imposts" and the "intolerable burdens" by means of which, it was alleged, Scottish trade had been "dogged" both at home and abroad. Among the specific complaints advanced was one that, very much to the prejudice of Glasgow merchants who were seeking to develop commercial relations not only with Continental countries but with the English "plantations," Scottish ships were prohibited from trading with the American colonies, while the English Government were said to have confiscated in those colonies any English ships of whose crews Scotsmen constituted more than one-third. *Per contra*, Scotland had, among other things, prohibited under heavy penalties the importation into that country of English woollens; and, altogether, Defoe found occasion to remark, in his "History of the Union of Great Britain" (1709), that the two Governments "seemed bent to act counter to one another in all their Councils."

These conditions were, happily, changed by the Union, Article 4 of the Treaty then agreed to stipulating that "all the subjects of the United Kingdom of Great Britain shall, from and after the Union, have full freedom of Trade and Navigation to and from any port or place within the said United Kingdom and the dominions and plantations thereunto belonging." Complete freedom of trade between the two Kingdoms was thus established; the former tolls, duties and restrictions on either side were withdrawn, and Scottish merchants and manufacturers were now at

full liberty to trade alike with England, with England's colonies and with foreign countries.

In anticipation of the benefits expected to result from these new conditions, there was, as Campbell further relates, "much discourse of uniting the Firths of Forth and Clyde."

Another hundred years were to elapse before the beginning in England of the McAdam period of improved roads. In Scotland itself roads, apart from those which had been constructed to serve military purposes, were practically non-existent, and Scottish trade with England was mainly confined to such portions of the country as could be reached, or served, by coasting vessels. The limited means of communication thus alone available would, it was urged, be enhanced by the provision of a Mid-Scotland waterway, and "great advantages," as Campbell further says, were "proposed from it" by writers of the period, more especially in view of that increase in the trading relations between the two countries which was now confidently predicted.

Among these writers was Defoe, the historian of the Union, who thus refers to the subject in his "Tour through the Whole Island of Great Britain" (1724-26):—

The two Firths, from the Firth of Clyde to the Firth of Forth, have not an Interval of above twelve or fourteen Miles, which, if they were join'd, as might easily be done, they might cross Scotland, as I might say, in the very Center.

Nor can I refrain mentioning how easy a Work it would be to form a Navigation, I mean a Navigation of Art from the Forth to the Clyde, and so join the two Seas. . . . What an advantage in Commerce would this be . . . making a communication between the West Coast of Scotland and the East Coast of England, and even to London itself; nay, several Ports of England, on the Irish Sea, from Liverpool Northward, would all Trade with London by such a Canal, it would take up a Volume by itself, to lay down the several advantages to the Trade of Scotland, that would immediately occur by such a Navigation, and then to give a true Survey of the Ground, the Easiness of its being perform'd, and the probable Charge of it, all which might be done. But it is too much to undertake here, it must lye till Posterity, by the rising Greatness of their Commerce, shall not only feel the Want of it, but find themselves able for the Performance.

Without, however, waiting for such action as Posterity might take, the merchants of Glasgow, as we also learn from Defoe, were already establishing themselves at Alloa—then known as "Alloway"—on the north bank of the Forth, "erecting Magazines or Warehouses, to which they propose to bring their Tobacco and Sugars by Land and to ship them for Holland, or Hamburgh, or the Baltick, or England, as they find Opportunity or a Market." Defoe speaks of the navigation at Alloa as better than at most of the towns on the Forth. A ship of 300 tons could "lye at the very Wharf"; and trading with all parts of the world could, he says, be done as well there as at Leith and Glasgow.

EARLY SURVEYS.

The first definite survey of the route of a possible canal linking up the two firths is believed to have been made in 1723 by Mr. Gordon,

described by certain authorities as "an engineer of some repute," and by others as Alexander Gordon, the antiquary, who published in 1726 his "*Itinerarium Septentrionale: or, a Journey through most of the countries of Scotland and those in the North of England.*"¹ The main purpose of this famous old book was to "illustrate the Roman actions in Scotland and the Achievements of its Ancient Inhabitants"; but, in writing it, Gordon showed an intimate acquaintance with the whole of the country between the Forth and the Clyde, his attention being specially directed thereto on account of his search for traces of the Roman wall—otherwise "Graham's Dyke"—made between the two firths by Lollius Urbicus, in the reign of the Emperor Antoninus Pius, A.D. 144. The results of this search are told, and illustrated, with much detail in Gordon's book.²

Whatever the identity of the first surveyor of a route for the proposed canal, the report made by him was not published, and practically all that can be ascertained concerning it is the statement that the estimate of the cost of construction was such as to deter the projectors of that date from taking any further action.

To William Pitt, afterwards the Earl of Chatham, is attributed the design of establishing, at the public expense, a waterway connection between the two firths on such a scale that vessels of moderate burden would be able to pass from sea to sea; but he resigned office in 1761 before he could give effect to these proposals.

In 1762 Lord Napier employed Robert Mackell and James Murray to make surveys and prepare estimates for a canal which would leave the Clyde at Yocker Burn, about five miles below Glasgow, and join the Carron at Abbotshaugh, two miles from the point where the Carron discharges itself into the Forth. They were also to collect details as to the probable traffic on such a canal and the revenue it would be likely to secure.

The report made was so encouraging that further steps were taken by the public body known as the "Board of Trustees for the Encouragement of Fisheries, Manufactures and Improvements in Scotland." Under Article 15 of the Treaty of Union, it had been specified that £2,000 a year should be set aside annually, for a period of seven years, to encourage the manufacture of coarse wool in Scotland. Several later Acts allocated further sums for encouraging fisheries and such manufactures and improvements in Scotland as might conduce to the general good of the United Kingdom. Under an Act of 1727, all these various grants were combined in a single fund the control and distribution of which, on the basis of "a particular plan or method" then laid down, and in conformity with "the tenor and true meaning" of the said Article 15 of the Treaty of Union, were delegated to Trustees appointed for that purpose. These

¹ A Falkirk contributor to Sir John Sinclair's "*Statistical Account of Scotland*" (1791-98) speaks of the survey as having been made by "Mr. Gordon, well known as the Author of the '*Itinerarium Septentrionale.*'"

² As subsequently constructed, the Forth and Clyde Navigation followed for some distance the course of this Roman wall, the foundations of which, alongside, are still to be observed in the neighbourhood of Kirkintilloch.

Trustees appear to have regarded an investigation into the possibilities and prospects of a Mid-Scotland Ship Canal as coming within the scope of their powers, and, following on the report by Mackell and Murray, they, in 1763, employed John Smeaton, then the most eminent engineer of his day, to make, on their account, a further survey of the same route as that already proposed by Lord Napier.

A CHOICE OF ROUTES.

Smeaton presented his report in March, 1764, and he showed therein that there were two routes between which a choice could be made. Dealing with the general configuration of the land between the Forth and the Clyde, he wrote:—

It is somewhat remarkable that, notwithstanding the country at this place lies in general as high if not higher than the rest, yet that through this high ground there happen to be two different passages, both lower than any of the others, and so much appearance of equality in point of practicability that upon ocular surveys, it has remained a doubt which of the two ought to be preferred. One of these passages is from the River Carron, by way of the Bonny, through the Bog of Dolater into the Kelvin and from thence into the Clyde by way of the Yocker Burn. The other is by following the River Forth some miles above Stirling and then crossing on through the Bog of Bollat into the water of Enrick down to Loch Lomond, and from thence by the River Leven into the Clyde at Dumbarton.

Smeaton himself recommended the former route in preference to the latter, and in this respect, at least, his advice was concurred in by all the parties then concerned.

Controversy has been especially active in recent years as to the choice that should be made between what is known as the "Direct Route" and the "Loch Lomond Route" for a Mid-Scotland Ship Canal. The fact that Smeaton himself was unfavourable to the Loch Lomond route is regarded in some quarters as prejudicial to the choice of it for the project of to-day. But what Smeaton had in his mind, when he estimated for a canal by the Loch Lomond route in 1764, was a line of navigation which, starting from the Clyde at Dumbarton, would first utilize the River Leven—to be rendered navigable at all times by the provision of locks and dams—and continue thence, for a distance of seven miles, across Loch Lomond to the mouth of the Enrick, entrance to which would be facilitated by the construction of two jetties running into the loch for a distance of three-quarters of a mile. With the help of further locks and dams, supplemented by a cutting across one neck of land for about a quarter of a mile, the line of navigation would be along the Enrick until a point was reached from which a canal could be cut across the Bog of Bollat—rising to a summit level of 202 ft. above Loch Lomond and 225 ft. above neap tides in the Clyde—to the River Forth, near Keltie Water. From this point navigation would continue along the Forth itself for practically the remainder of the journey, certain rapids in the stream being overcome by means of two more locks and another dam. So winding, however, is the course of the Forth that from Keltie Water to Stirling the distance,

following the stream, is twenty miles, against twelve miles by land, while between Stirling and Alloa the distance is twenty-four miles by water, and only *four* by land !¹ In the latter section Smeaton did purpose to cut across some of the bends ; but otherwise he thought the course of the river should be followed inasmuch as the advantages to be gained by cutting off the other loops would, in his opinion, not be worth the expense.

The total length of the navigation, from Dumbarton to Alloa, including all the river windings, would be seventy-three miles ; but in this distance there were to be only seventeen miles of artificial canal, the remainder, save for the short stretch in Loch Lomond, consisting of canalized rivers.

All this, as will be shown more clearly later on, was a very different proposition from what is to-day known as the " Loch Lomond route," and the fact that Smeaton himself was averse to proceeding via Loch Lomond has no bearing at all on the later proposals.

The other scheme, and the one which, as we have seen, Smeaton favoured, was for a canal starting from a point—about three miles up the navigable Carron—known as Carron Shore, and thence proceeding along the valleys of the Bonny and the Kelvin to the Clyde, just below Glasgow. In this Carron route there would be twenty-seven miles of artificial cuttings, as against seventeen miles in the Loch Lomond route ; but Smeaton still thought that the former would cost less to construct because of the larger number of locks necessary on the latter, in order to overcome the greater elevation. In respect to the Carron route, he gave estimates for a canal 7 ft. deep, the total cost of which he put at £80,000.

There had been some expectation that the expense of carrying out a project designed to confer much benefit on Scotland in general would be met out of the Forfeited Estates Fund.² No State aid from this fund appeared likely, however, to be forthcoming, and it was concluded that, if a Forth and Clyde Canal were built at all, the necessary capital would have to be raised by private enterprise.

COUNTER MOVEMENT FOR A SMALL CANAL.

Certain commercial interests at Glasgow and Carron (where ironworks of, at that period, exceptional magnitude and importance had been set up) thereupon professed to doubt if, in the absence of State aid, it would be possible to obtain from the public the funds needed for building a canal of the length and dimensions proposed by Smeaton, and, also, if, assuming that the canal could be built, it would get such an amount of traffic as would yield a return on the capital expenditure. They also represented that there was no need for the canal to go further west than Glasgow. Nine-tenths of the goods passing between the two seas would, they argued, be received at or despatched from Glasgow, whose traders, together with those at Carron, would be " more interested in the navigation than all the rest of the world." Edinburgh, especially, they declared, had no more concern with the matter than if it were a proposal for a turnpike road in Ayrshire.

¹ See map on p. 200.

² See footnote on p. 51.

In December, 1766, the interests in question commissioned Robert Mackell and James Watt to make further investigations with a view to finding a shorter route for a canal which, connecting with the Clyde nearer to Glasgow, would be of smaller dimensions and cost less to construct than the canal proposed by Smeaton. Mackell and Watt made investigations accordingly and reported on two other possible routes—a north track and a south track. They also suggested, in the first instance, that, “to lessen expense,” the canal should be 18 ft. wide and 3 ft. deep, with locks 80 ft. long and 9 ft. wide; though in their published report¹ they said that “to remove all objections” the “present undertakers” proposed to make the canal 4 ft. deep and 24 ft. wide, with locks 10 ft. wide and 60 ft. long, admitting boats drawing 3 ft. water. The cost of a canal of these latter dimensions along the north track (which they recommended) was estimated by them at £50,000.

Without, however, waiting for this report, a group of merchants, traders and manufacturers in the city of Glasgow signed a petition which was presented to Parliament on January 23rd, 1767, by Lord Frederick Campbell, praying for leave to bring in a Bill for a canal of the type in question. The petition was referred to a Committee of the House of Commons. This was followed by a meeting in Glasgow, on February 4th of the same year, at which it was announced that £30,000 would probably be sufficient for constructing a canal of smaller dimensions than those proposed by Smeaton, and the decision was then arrived at to raise a subscription of £40,000, estimated to cover the cost alike of surveys, of Parliamentary proceedings, and of constructing the canal. A fortnight later there was another meeting at which it was reported that only £15,800 had been subscribed towards the desired £40,000; but two individuals present undertook to complete the amount by providing a further £24,200 between them.

These proceedings on the part of the Glasgow promoters greatly alarmed the Board of Trustees and the gentry resident in the neighbourhood of Edinburgh, each alike anxious for the carrying out of the larger scheme. Success of the Glasgow project for a small canal going no further west than that city would have meant the abandonment of the long-cherished dream of a waterway stretching across Scotland from ocean to ocean, capable of accommodating sea-going vessels, and constituting a national and international highway. It would, also, have put into the hands of Glasgow and Carron interests practically the whole business of transshipment, conveyance and warehousing of goods passing between the Forth and the Clyde by way of the canal, giving them a monopoly of the traffic.

THE “NATIONAL” VIEW.

Against this dual prospect a most vigorous opposition was aroused.

The Board of Trustees announced, on February 6th, 1767, that they

¹ “An account of the Navigable Canal proposed to be cut from the River Clyde to the River Carron, as surveyed by Robert Mackell and James Watt.” Plan. London, 1767.

had decided on the immediate publication of Smeaton's report, plan and estimates, copies of which would be transmitted to the Government. On March 16th, the Glasgow Bill was presented to the House of Commons and four days later it was referred to a Committee of the House. Thereupon the need for action on the part of the objectors was regarded as more pronounced than ever.

On April 8th there was held in Edinburgh a meeting of the leading residents of East Lothian at which it was decided to oppose the Bill and to present to Parliament a petition praying that further consideration of the measure should be deferred until the following Session. At other meetings held in the counties of Haddington, Stirling, Linlithgow, Fife, Aberdeen, Elgin, Selkirk, Perth and Banff it was resolved to join with East Lothian. Petitions against the "Small-Canal Bill," as it was called, began to shower upon the House of Commons.

One that was presented, on April 28th, 1767, by landowners of the County of Midlothian; the Lord Provost, Magistrates and Town Council of the City of Edinburgh; landowners of the County of Linlithgow; the Magistrates, Town Council, traders and manufacturers of the borough of Queensferry; the Company of Merchants of the City of Edinburgh, and the merchants and shipowners of the Port of Leith set forth—

That the joining of the Firths of Forth and Clyde by a proper navigable canal, and thereby opening a communication between the east and west seas is a matter of the utmost importance to the trade and manufactures of this kingdom; and that the survey, plan and estimates thereof has been made by Mr. Smeaton, an eminent engineer, and that the petitioners, with no small concern, observe a Bill for making and maintaining a navigable cut or canal from the River Clyde at or near the City of Glasgow in the County of Lanark to the River Carron, at or near Carron Shore, in the County of Stirling; which would be partial or local; whereas the benefit of the great canal planned by Mr. Smeaton would be national and universal, and that as the small canal is intended to occupy the ground and water intended for the large one, the public will for ever be deprived of all the advantages which might reasonably be expected from Mr. Smeaton's plan.

Therefore the petitioners asked for delay and for permission that they might be heard by counsel against the Bill passing into law that Session.

Other public bodies or individuals supporting petitions to a like effect included the Annual Committee of the General Convention of the Royal Burghs in Scotland, the Commissioners of Land Tax of the County of Haddington, freeholders of the counties of Clackmannan and Stirling, and merchants and traders of various towns.

A further petition, presented in May, 1767, informed the House of Commons that various persons had subscribed £100,000 for the making of a canal at least as deep and as wide as that proposed by Smeaton, and having branches both to Glasgow and to Borrowstounness (Bo'ness). The subscribers had, also, undertaken to apply to Parliament in the next Session for the necessary powers. The petition prayed that the Bill then before the House should not become law. Thereupon the Glasgow Bill was thrown out.

A COMPROMISE.

The amount actually subscribed at this time for a "great" canal was £99,500, and at a meeting held in London on May 27th, 1767, under the presidency of the Marquis of Queensberry ("Old Q"), an influential committee was appointed to act there in furtherance of this more ambitious project. In view, however, of prospective vigorous opposition, there was effected with the Glasgow-Carron supporters of the "4-ft. ditch," as it was called, a compromise which was to have an important bearing on the further development of the whole subject.

Smeaton had been instructed to prepare additional estimates for a canal having alternative depths ranging from 5 ft. to 14 ft., proposals having been made that the waterway should have greater, rather than smaller, proportions than had been previously contemplated; and these new estimates led to fresh controversies.

According to the writer of "A Letter to William Pulteney, Esq., on the Subject of the Forth and Clyde Navigation. From a Proprietor" (Edinburgh, 1768), Mr. Chambers, an Edinburgh merchant of "extensive commercial knowledge and great public spirit," and "other persons of knowledge in trade and navigation" strove long and strenuously to secure a 9-ft. deep waterway. It seems, however, to have been part of the aforesaid compromise, not only that Glasgow itself should be assured a branch canal of the same dimensions as the main canal, but that the latter should have a depth of not more than 7 ft.

So it was that, having regard to all these circumstances and conditions, the promoters decided to seek powers for the making of a 7-ft. deep canal from Grangemouth to Dalmuir, with branches to Glasgow and Bo'ness, the branch to Glasgow to be of the same dimensions as the main canal.

These powers they obtained in March, 1768,¹ the preamble of their Act (8 Geo. III, cap. 63) stating:—

Whereas the making of a navigable Canal from the river Forth, at or near the mouth of the river Carron, in the county of Stirling, to the river Clyde at or near Dalmuir Burnfoot² in the county of Dumbarton, through the counties of Stirling, Lanark, Renfrew and Dumbarton, with a collateral cut to Glasgow, will open an easy communication between the Firths of Forth and Clyde, as also between the interior parts of the country, which will not only be a great advantage to the trade carried on between the said two Firths, but will also tend to the improvement of the adjacent lands, the relief of the poor, and the preservation of the public roads, and, moreover be of great utility, and, whereas the persons after named are desirous at their own charges, to begin, carry on, and complete the said Canal and collateral cut, be it enacted, etc.

The authorized capital had been fixed at £150,000, with power to raise a further £50,000 if necessary, and the sum actually raised when the Act was obtained was £130,000. The Glasgow Corporation subscribed £1,000 towards the undertaking, as was thus stated in the official records:—

¹ The power to construct a branch to Bo'ness was never exercised.

² Subsequently altered to Bowling Bay, on the River Clyde.

Glasgow, 5th of Febrarie 1767 years. The Magistrates and Councillors convened, authorise the Lord Provost, in their name, and behoove of the community of this City, to subscribe the sum of £1,000 sterling, towards defraying the expence of making a Canal, or cutt, betwixt the Carran shoar to the City near to the Broom-lew.

CONSTRUCTION DIFFICULTIES.

The work of construction, begun at the east end in July, 1768, was attended by "many and unforeseen difficulties," the story of which is told by James Hopkirk, deputy-chairman of the Forth and Clyde Committee, in his "Account of the Forth and Clyde Navigation from its origin to the present time"—that is to say, down to 1818, when the said account was published in Glasgow. The Canal Committee consisted mainly of country gentlemen and public officials, and the details of canal construction were then but little understood. There was, consequently, great embarrassment from time to time and considerable waste of money. The ground at Grangemouth was a rich soft loam, and was not then regarded as favourable either for the canal or for the construction of harbours, although Grangemouth, where a port was founded by Sir Lawrence Dundas in 1777, was to become the eventual terminus of the canal on the east. In the fourth mile from the east there were ten locks. Altogether twenty locks were needed to raise the canal from the Carron to the summit level, 156 ft. above mean sea level. Beyond the highest of these twenty locks the summit level was continued for a distance of eighteen miles, whence the descent to the Clyde was to begin (see diagram on p. 107).

On the summit level the canal passed through Dollater Bog—a moss of considerable depth. In Hopkirk's opinion, this line of route was a great mistake. If, he says, a circuit of about a quarter of a mile had been made, the bog could have been avoided and the canal taken through solid ground. Owing to this mistake unnecessary expense was incurred and there was much interruption of the work. Banks, apparently sound, sank several feet a day and had to be renewed. It was declared that about 55 ft., perpendicular, of earth and stone had to be laid down, at different times, upon the canal banks before these were sufficiently secure.

Navigation as far as Kirkintilloch, nine miles east of Glasgow, was opened in 1773. The canal was there carried over the Water of Logie by an aqueduct bridge consisting of a single arch, the span of which was 90 ft. It was built in three sections of 30 ft. each, the central section being moved into position on small rollers and attached to the two other sections in such a way that the joinings were perfectly level. No such engineering feat had previously been attempted with a bridge of this size.

FINANCIAL TROUBLES.

By this time the liabilities already incurred had amounted to £212,000 and the Company obtained an Act of Parliament authorising them to borrow £70,000 on their own security; but no further capital could be raised, and in July, 1775, work on the canal, which had then been completed as far as Stockingfield, about three miles north of Glasgow, had

to be stopped for want of funds. The whole of the money subscribed, the proceeds of a subsequent loan, and the revenue from canal dues, (bringing in at that time no more than about £4,000 a year) had been expended, and there seemed to be no prospect of carrying the canal down to the Clyde, especially as some of the most important construction work had still to be done.

Thereupon the Glasgow interests raised a sum sufficient to pay for a collateral cut from Stockingfield to Hamilton Hill, on the outskirts of Glasgow. This branch was completed in November, 1777. At Port Hamilton, as the terminus was called, a basin was provided for the reception of vessels using the canal, and granaries and other buildings were erected alongside.

Glasgow thus obtained a direct connection with the Forth ; but the extension of the main line of the canal from Stockingfield to the proposed junction with the Clyde, eleven miles further west, came to a stop. The shares in the canal company's stock had fallen to half their original value ; Scottish investors did not seem disposed to put any more money into an enterprise that looked financially unpromising, and there was little or no money to be got for the purpose from England.

JOHN KNOX AND THE FORTH AND CLYDE CANAL.

When John Knox published the first edition of his " View of the British Empire," in 1784, the collateral cut of the Forth and Clyde Canal had, as just shown, been brought to the outskirts of Glasgow from the point where the construction of the main waterway had stopped in 1775 ; and the recommendation he made concerning a " southern navigation " (see p. 7) was for the completion of the original work by the continuation thereof for the remaining distance in order that the actual connection between the Forth and the Clyde could be effected, thus, in combination with the Crinan Canal and the Caledonian Canal, as also proposed by him, allowing of a circumnavigation of the northern counties of Scotland east of the Great Glen, as well as affording facilities for direct water transport between the east coast and the Western Highlands and Islands. This last section of the Forth and Clyde Canal was, in fact, one of those three " shorter communications " which, in the opinion of Knox, formed the basis of all the improvements in the development of the Highlands and of Scotland in general at which he was aiming.

That he should regard the stoppage of the canal short of its proposed junction with the Clyde as a regrettable fact was, in the circumstances, only natural ; but in the third and enlarged edition of his book (1785) he indulged in some very strong remarks concerning various developments in the canal scheme as a whole.

Having given an outline of the events in connection with the earliest proposals down to the resignation of the Earl of Chatham, he proceeds :—

The business thus abandoned a second time by the State, was now taken up by individuals, some of whom were suspected of private views, inimical to the general welfare of the community ; and from this time forward we are to consider this great

work sacrificed to the hopes of gain, of influence, and to jobbing, first in respect to the direction of the canal and secondly to its dimensions. Nature had pointed out Borrowstounness on the Forth, and Dalmure Burnfoot, six miles below Glasgow on the Clyde, as the two extremities of this inland navigation; but such was the force of influence that instead of opening the east end of the canal at Borrowstounness, where there is water, at neap tides, for ships of 200 or 300 tons burden, and safe lying, it was begun on the river Carron, at the distance of a mile from its junction with the Forth, and four miles above Borrowstounness, where vessels could not float at neap tides; besides the delay and inconveniences of navigating the Forth, and the mouth of the Carron, from floods and contrary winds; also a circuitous navigation of at least two miles.

The depth of water, and dimensions of the canal, came next under consideration, and gave rise to much controversy between the inhabitants of the east country on the one part and a considerable number of the citizens of Glasgow on the other.

When we consider that the space to be cut did not, with all its windings, exceed 30 or 32 miles, and that this short navigation would at once open a communication between the two seas, common reason pointed out the propriety of the greatest depth of water that the nature of the country would admit. This was the desire of the nation in general, and it would have been the interest of Ireland, London, Bristol, Liverpool and other towns in England to have subscribed towards a design in which their commerce, especially in time of war, was materially interested.

This circumstance was, however, neglected by the merchants; and those of the Scottish nation who were friends to a deep canal, seeing themselves overpowered by their opponents, submitted reluctantly to an imperfect navigation. Mr. Smeaton, an able engineer from Yorkshire, had estimated the expence of 4, 7, 10 and 14 feet water. Certain merchants of Glasgow adopted the scale of 4 feet, which, though sufficient for the trade of that city would scarcely have answered any valuable purpose to the nation in general; and it was surmised, no doubt invidiously, that those persons never meant that the canal should join the Clyde. While a bill for cutting the proposed ditch of 4 feet water was before Parliament, and on the brink of being passed, the east country gentlemen took the alarm, objected to the trifling design, and, fortunately for the public, obtained a bill extending the depth of water to 7 feet.

Dealing with the later history of the canal, Knox alludes to the difficulties experienced in the navigation of the Carron, mentions that in 1784 a Bill was obtained for the construction from Borrowstounness (Bo'ness), of a new connection, designed to join the existing canal near Falkirk—though this branch was never made—and goes on to say:—

The whole business hath been a series of blunders and unnecessary expence, in which the public spirited proprietors are equally involved with those whose selfish views hath proved so detrimental to the whole design in all its stages.

The views thus expressed by John Knox were fully confirmed by a pamphlet (8 pp. folio) published in Edinburgh in 1786 under the title of "Thoughts on the Present State of the Forth and Clyde Navigation Company. Humbly addressed to the worthy Noblemen, Gentlemen and Traders, Proprietors in that most useful National Undertaking." The pamphlet was published anonymously; but the writer speaks of himself as "an enthusiast about this Navigation from the beginning," as "having had as extensive experience of coasting, and river navigation as any person perhaps now alive," and as "having thought more on this affair than any other proprietor."¹

¹ A copy of the pamphlet will be found in the Mitchell Library, Glasgow.

At the outset he says:—

It has long given him inexpressible concern, that this noble undertaking which has already, so far as it is completed, proved of the greatest service to commerce in general, should be so losing a venture to those who with so much public spirit embarked in it, and that there should be no present prospect of its mending, but rather of a total loss of the capital unless the system of management is entirely changed.

He goes into much detail concerning what he regarded as the defects and shortcomings of the undertaking and its management, and the measures that should be taken to remedy them. In alluding to the conditions under which the canal had been originally made he says:—

The foreign merchants and considerable manufacturers of Glasgow are a good pattern of spirit and industry and an honour to Scotland and every good Scotsman should wish the prosperity of this most respectable city and its environs. . . . But the principal traders there do not at all understand coasting and canal trade, which makes them by themselves improper managers of this Company, and liable to be imposed on by every interested or ill-informed person; and the whole inhabitants suck in with their milk a predilection, laudable in itself, for the interest of that community to which they think everything else would yield.

This conduct and belief has been notorious in the business of the Navigation, the completing of which between the two seas, for the benefit of the national trade in general, they have always opposed with the utmost, though generally covered vehemence. It is well known how much they struggled at the beginning for the erection of a very small lighter navigation, which would have been useful to the city of Glasgow only; and by occupying the water and track, would have for ever prevented a junction by proper vessels between the seas. It is known how much they pushed, and perhaps but reasonably, the completing of the side cut to Glasgow in preference to the main branch going on. That they were always averse in the business of obtaining public aid, hoping thereby to prevent the completion of the work; and it is well known what extraordinary efforts they made lately, to have the junction of the Canal to terminate only a mile or two below Glasgow.

This they supported by many frivolous and specious pretences, particularly that it would save money in the execution, which led away people who had not fully considered the subject. Had this plan of theirs succeeded, instead of the noble original scheme of making the nearest and most convenient junction between the two seas, the whole trade that passed that way would have been subjected to the heavy tolls, and generally to lighterage, on their shallow and inconvenient river navigation; which, while it confined the trade to, and advanced the revenue of the city of Glasgow, the noble original purposes of the undertaking, for accommodating the public at large, would have been totally, or in a great measure frustrated.

THE EXTENSION TO THE CLYDE.

As time went on, the Committee of Management became more and more convinced there would be no possible prospect of the subscribers getting any return on the very large sum already expended so long as the canal went no further than Glasgow and failed to afford that through connection between sea and sea which, from their point of view, was the purpose the undertaking had been expressly designed to serve. Failing other means of raising funds, they at last appealed to the Government for assistance, and in 1784 there was passed an Act (24 Geo. III, c. 74) authorizing an advance to the Company of Proprietors of the Forth and Clyde Navigation, under certain conditions in respect to repayment, of

£50,000 from the Forfeited Estates Fund, to allow of the undertaking being completed. The work of continuing the main line of canal to the Clyde was thereupon proceeded with, after it had been suspended for no less a period than nine years.

COMPLETION OF THE WORK.

What had still to be done included, not only the provision of nineteen more locks, in order to take the canal down to the Clyde at Bowling Bay (substituted for Dalmuir as the western terminus), but the construction of an aqueduct bridge by means of which the canal could be carried over the Kelvin river and valley.

This aqueduct was regarded as one of the most notable engineering achievements of the day. An enthusiastic writer in Sir John Sinclair's "Statistical Account of Scotland" declared that it might be "justly reckoned the most stupendous [bridge] of its kind in the world"; though James Hopkirk is content to say that, in regard to its length and the weight of water it had to sustain, it was (at that time) the largest in Britain. Designed by Robert Whitworth, who was now in charge of the work of completion, the bridge, which stands on four arches, has a length of 245 ft. 6 in. between the faces of the abutments, is at a height of 50 ft. above the surface of the river, and has a breadth of 57 ft. The cost of construction amounted to over £9,000.

So important an achievement could not be initiated without due ceremony, and on June 15th, 1787, the Committee of Management, with other of the proprietors, and accompanied by a band of music, proceeded in the company's private barge along the canal to the Kelvin, where the foundation stone was well and truly laid by the chairman of the committee. In a bottle deposited in a cavity under the foundation stone there was placed a tin plate on which was recorded, among other things, the fact that the aqueduct bridge was designed "for carrying the Navigation betwixt the Forth and the Clyde."

The junction with the Clyde, at Bowling, was effected July 28th, 1790, twenty-two years after the work of construction had been commenced. On this occasion the Committee of Management went in their barge from Port Hamilton, accompanied by the Magistrates of the city of Glasgow, to the Clyde at Bowling, the journey of eleven miles—including the passing through the nineteen locks which overcame the difference of 156 ft. between the summit level of the canal and the tideway of the Clyde—being accomplished in "less than four hours." On the arrival of the party at Bowling a hogshead of water, taken from the Forth, was discharged into the Clyde "as a symbol of the junction of the eastern and western seas."

In August, 1790, the sloop *Agnes*, 80 tons, built at Leith for the herring fishery, arrived at Greenock from that port—the first vessel to pass direct from the Forth to the Clyde. In May, 1791, the *Experiment* sailed from Dundee to Liverpool, by way of the new canal, in the then unprecedented time of four days.

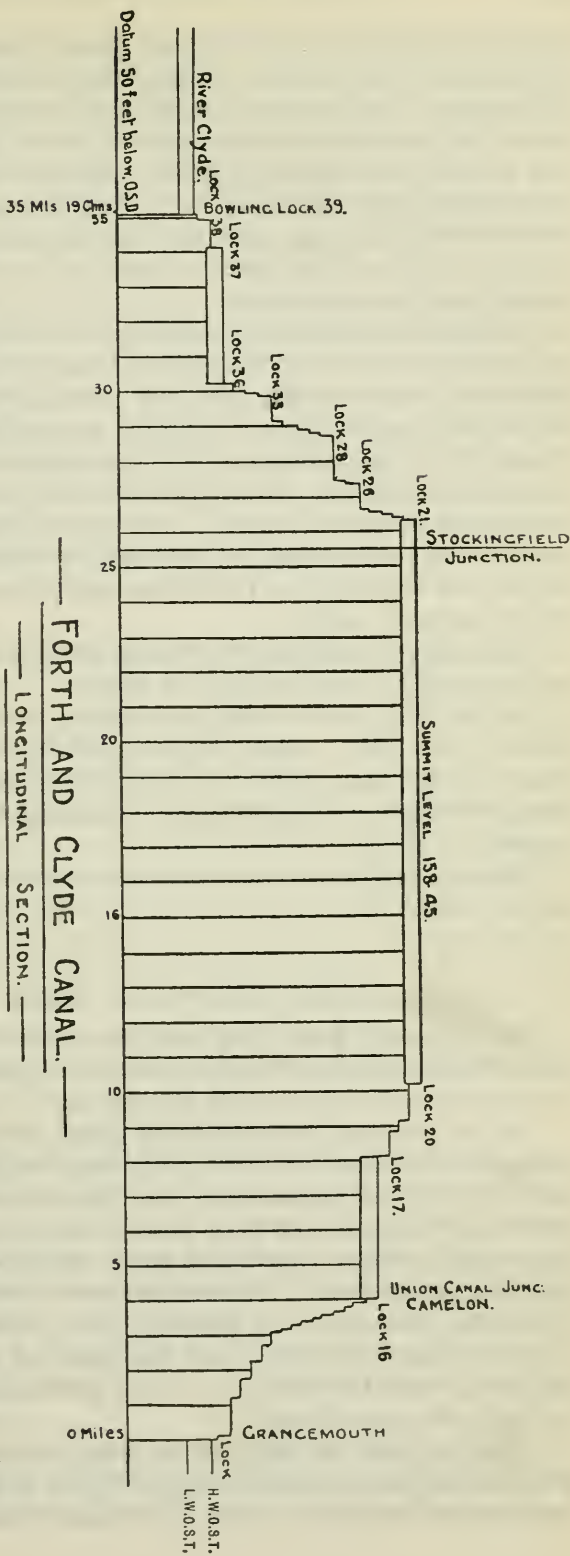
The terminus of the Glasgow branch at Port Hamilton being found

inadequate to the increasing traffic, an Act was obtained, in 1790, for the construction of a basin on a larger scale at a point somewhat nearer Glasgow to which the name of Port Dundas was given in honour of the governor of the company, Lord Dundas of Kerse. Some eight acres of land were acquired for the purposes of the basin. Located on the side of a steep hill, Port Dundas stands about 70 ft. above the level of the streets at the base thereof, and is to-day within half a mile of the Caledonian Railway Company's Buchanan Street Station.

By the same Act the Company of Proprietors were authorized to form a junction with the Monkland Canal, of which an account will be given in Chapter VII.

CONSTRUCTION DETAILS.

The length of the Forth and Clyde Navigation, from its starting-point about two miles up the river Carron, at Grangemouth, to Bowling, about ten miles below Glasgow is 35 miles; that of the collateral cut to Glasgow is $2\frac{3}{4}$ miles, and that of the junction between Port Dundas and the Monkland Canal is one mile,—a total of $38\frac{3}{4}$ miles. The main canal



(apart from the branch to Glasgow) passes through or near to the towns of Grangemouth, Falkirk, Bonnybridge, Kilsyth, Kirkintilloch and Clydebank. The number of locks rising to or descending from the summit level of 158 ft. 6 in. above Ordnance datum is 39, the difference between the number on the east (20) and the number on the west (19) being accounted for by the difference in level between the two rivers. Each lock is 68 ft. 6 in. long and 19 ft. 10 in. wide, with a rise of 8 ft. The average width of the canal is about 63 ft. on the top water level, and about 30 ft. at the bottom.

In regard to the depth, mention has been made of the fact that, as a concession to the Glasgow interests, the powers originally obtained in 1768 were for a canal only 7 ft. deep; but this limit was soon found to be inadequate, and in 1787 a further Act was obtained which authorized the raising of the banks so as to give an average depth of 8 ft. This, in turn, was found insufficient, and a still further Act, obtained in 1814, authorized an increase of depth to 10 ft. The present depth is 9 ft. 6 in. As the result of these elevations of the banks, to allow of the greater depths, the original water level of 156 ft. was raised to 158 ft. 6 in., which remains the water level to-day.

The canal is navigable for vessels 68 ft. 6 in. in length, 19 ft. 8 in. beam and 8 ft. 9 in. draught of water.

In addition to that over the Kelvin, already spoken of, the canal passes over nine other large aqueducts and thirty-three smaller ones. It is, also, spanned by fifty-two bridges. These are either bascule bridges or swing bridges, admitting of the passage of masted vessels.

Water is supplied to the canal from nine reservoirs, covering an area of 721 acres.

STEAM NAVIGATION: EARLY EFFORTS.

One especially interesting point in connection with the early history of the Forth and Clyde Canal relates to the part played by the waterway in the development of steam navigation.

In the year 1786, Patrick Miller (1731-1815), a Scottish banker who had made a fortune and retired to his estate at Dalswinton, Dumfriesshire, was devoting his attention to the idea of constructing vessels which, furnished with double or triple hulls, could be fitted, between those hulls, with paddle-wheels capable of being worked by manual labour from capstans on the deck. He launched one vessel of this type in October, 1786, and another in the following year, when, however, he wrote:—"I have reason to believe that the power of the steam engine may be applied to work the wheels. . . . In the course of this summer I intend to make the experiment."

The conclusion at which Miller thus arrived had been inspired by the fact that William Symington (1763-1831), a civil engineer who, in 1786, in conjunction with his brother, had constructed a working model of a

steam road-carriage, followed up this invention by taking out, in 1787, a patent for an improved type of steam engine ; and it was this particular engine which the retired banker and amateur boat-builder thought might be substituted for manual labour in the working of his paddle-wheels. He accordingly employed Symington to make for him an engine on the lines of the 1787 patent, and fit it to a double-keel boat 25 ft. long and 7 ft. broad then on the lake at Dalswinton. Symington made an engine which had cylinders 4 in. in diameter and furnished the rotary motion by means of chains and ratchet wheels. Fitted to the vessel as desired, the engine answered so well in the propelling of the paddles when the experiment was made in October, 1788, that Miller decided to have another test, this time on the Forth and Clyde Canal, with a larger boat fitted with a steam engine having two cylinders each 18 in. in diameter. Symington had the engine made, under his own direction, at the Carron ironworks ; the larger boat, furnished with paddle-wheels, was built by Patrick Miller for the purpose, "and in October, 1789," as Symington himself records, "in presence of hundreds of spectators, who lined the banks of the canal, the boat glided along, propelled at the rate of five miles an hour."

On the occasion of another trial, in December, 1789, a speed of seven miles an hour was obtained ; but the experiments, which had attracted great attention both at home and overseas, were not continued by Patrick Miller, who then applied himself to other matters.

Among those, however, whose interest had been aroused was Thomas, Lord Dundas of Kerse, the Governor of the Forth and Clyde Canal, and he, in 1801, determined to carry through fresh experiments with a view to seeing whether steam traction could not be applied to the use of tug boats on the canal. He employed Symington to work out the scheme. Finding that his earlier engine would not serve the purpose now desired, Symington took out, in October, 1801, a second patent, this time for an engine in which a piston-rod, guided by rollers in a straight path, was connected by a connecting-rod to a crank attached to the paddle-wheel shaft. In this way and under these circumstances it was that Symington devised the system of working the paddle-wheel shaft which, from that time, was to be the one of universal application.

Meanwhile there had been built, at Grangemouth, for the purposes of the new experiments, a tug-boat which, known as the *Charlotte Dundas*, was 56 ft. long, 18 ft. beam and 8 ft. deep from deck to keel ; and to this vessel the new engines were fitted on completion, the paddle-wheel, acted upon in the way described, being in the stern. The first trials were in March, 1802, and the boat then steamed on the Forth and Clyde Canal from Lock 20 to Port Dundas, a distance of over nineteen and a half miles, against a strong head-wind, and towing two laden barges, each of seventy tons burden, in six hours.

Other trials followed, and all were a complete success in establishing the practicability of the engine for the purposes desired ; but the Company of Proprietors of the Forth and Clyde Navigation came to the conclusion

that, as they stated, "The undulation of the water from the paddle-wheel action would have the effect of washing away the banks of the canal," and they abandoned, for the time being, any further idea of employing steam power on their waterway. In 1803 another steam vessel, built on a somewhat different principle, was tried; but the proprietors of the canal were again afraid of damage to the banks and they adhered to their earlier decision. The *Charlotte Dundas* was beached in a creek between Locks 8 and 9 on the canal, and there she lay until, at last, her hull was broken up and portions thereof used for mementoes of the first steamboat ever constructed that was capable of being adapted to practical use, apart from earlier inventions ranking as no more than curiosities.

To-day one sees that the Company of Proprietors of the Forth and Clyde Canal missed the opportunity of establishing without further loss of time an innovation destined to effect revolutionary changes in the development of water transport, and to confer one of the greatest of blessings on the world at large. After the discouragement they had given to him, Symington was unable to obtain the financial support he needed for following up his invention, and he was to share the fate of many another neglected and impoverished pioneer; but the triumph he had won on the Forth and Clyde Canal, the proprietors notwithstanding, was soon to yield good results, and establish his fame for all time.

It may, indeed, be said that those who really assured the success of steam navigation were Robert Fulton, who launched the *Clermont* on the River Hudson, in the United States, in 1807, and Henry Bell, whose *Comet* began to ply on the Clyde in January, 1812; but Fulton—who did not take up the subject of the application of steam to navigation until 1793—may have gained some practical hints from what he saw of the *Charlotte Dundas* in 1801, while of Henry Bell it is recorded that he was present at the experiments on the lake at Dalswinton in 1789, and that, long before the *Comet* appeared on the Clyde, he was "a close and frequent spectator of Symington's vessel" during the many years she lay in the aforesaid creek of the Forth and Clyde Canal.

IRON BOATS.

As against the short-sightedness of the original Forth and Clyde Canal Company in the matter of steam navigation may be put the enterprise they showed by becoming, in Scotland, at least, the pioneers of iron-built ships.

Their first iron boat, the *Vulcan*, was constructed for them by Thomas Wilson, of Tophill, and was launched at Falkirk May 20th, 1818. Two small boats had previously been built of iron in England; but with these exceptions the *Vulcan* was the first iron boat on record, and it was certainly the first so far as Scottish shipbuilding was concerned. The boat was designed by the late Sir John Robinson, of Edinburgh, and was so substantially constructed that it was still afloat and doing duty in 1880.

Mr. R. Gillespie, editor of the third edition (1880) of William Nimmo's "History of Stirlingshire," adds, in narrating these facts:—

From time to time iron inventors have come forward and patented what they fancied new improvements in the construction of iron ships ; but, when the way to prosperity seemed clear to them, an examination of the old *Vulcan* ever proved that they had been forestalled, and consequently the patents become null.

CHAPTER IV.

CROSS-COUNTRY SCHEMES IN ENGLAND.

THE period at which, by the opening of the Forth and Clyde Navigation, the construction of a navigable waterway across Central Scotland became an accomplished fact was one when a number of cross-country canal schemes were being either projected or carried out in England ; and it is desirable to glance for a moment at some of these in order that the transport situation as a whole at this particular time may be understood.

Concurrently with the movement in favour of connecting the Forth and the Clyde, an Act for linking up the Trent and the Mersey had been obtained in 1766 ; one for the construction of the Leeds and Liverpool Canal, which had long been projected and was designed to join the Ribble and the Aire (already navigable from Leeds), so establishing direct waterway connection between Liverpool and Hull, was secured in 1770, while the junction of the Thames and the Severn, which, as stated on p. 93, had been proposed as far back as the time of Charles II, was finally decided upon in 1783.

It is true that these various proposals related only to barge or narrow canals, the physical conditions of the routes they followed rendering impracticable, in each instance, the construction of an artificial waterway for sea-going vessels. They were, nevertheless, all regarded as canals which would facilitate communications not only in the interior of the country but, also, by means of transhipment, between ports on both sides of England.

This was more especially to be the case with the Leeds and Liverpool Canal. After describing at great length all the local advantages which would be derived from the undertaking, the projectors said that others, no less valuable, would be conferred on the trade and industry of the kingdom " by opening this short, expeditious and safe connection between eastern and western seas." Commodities taken to Hull or to Liverpool by coasting vessel could either pass from sea to sea by means of the canal or be distributed among the industrial populations served by the new waterway, a fresh outlet being, at the same time, provided for their manufactures. Then the connection between " the Irish Sea and the German Ocean " (*sic*) would afford a cheap and ready transit for foreign trade to and from the Baltic, Holland, the Hanseatic towns, the Netherlands, France and Germany on the one side, and Ireland, the West Indies and America on the other. Finally, " in time of war " the waterway

was to be "a prodigious advantage" to the whole trading interests of England.

The realization of all these hopes in respect to cross-country connections by canal was, nevertheless, hampered by conditions not to be entirely overcome by the skill of even the ablest of engineers.

In its total length of ninety-three miles, the Trent and Mersey canal had to rise to a summit level of over 300 ft. It was carried across 127 aqueducts and culverts and through ninety-one locks and six tunnels, including the famous Harecastle tunnel, a mile and a half in length. Here, at least, there could be no idea of building a ship canal, and the capacity of the locks, tunnels and aqueducts was almost necessarily kept to that of the small-sized boats alone regarded as suited to the conditions to be overcome.

Similar considerations applied to the Leeds and Liverpool canal. In this instance the physical difficulties were of such a character that the canal—which was 108 miles long, 42 ft. wide at top and 27 ft. wide at the bottom—was not completed throughout until forty-six years had elapsed from the time the work of construction was begun. Writing in 1831, Priestley describes it as "one of the boldest and most magnificent projects hitherto attempted in Great Britain"; but it still ranked as no more than a barge canal.

The Thames and Severn, owing to the deficient navigation in the upper part of the former river, and, also, to the competition alike of other canals and of the railways, failed to realize the high anticipations which had so long been cherished in regard to it; though the fact must be admitted that, with its Sapperton tunnel, nearly two and a half miles in length, the Thames and Severn was as little adapted to serve the purposes of a ship canal as were the Trent and Mersey and the Leeds and Liverpool.

These and the many other canal schemes which came under consideration in England at the period in question may well have absorbed most of the money then available there for this particular form of undertaking; yet the physical difficulties in the way of constructing cross-country ship-canal projects in England gave additional importance to the corresponding proposals in Scotland, where they did appear to be quite practicable and likely to prove of national advantage.

CHAPTER V.

TRAFFIC DEVELOPMENT.

ANTICIPATIONS as to the commercial results likely to follow from the provision of a mid-Scotland waterway, such as the Forth and Clyde Navigation, had long been so high that when Campbell brought out his "Political Survey," in 1774, the Glasgow merchants—who, he says, had "always had their eyes" upon Alloa, "as lying so very conveniently for augmenting their commerce"—were already well established, with their warehouses and factories, at "the port of the Forth," in order to take advantage of the "conveniences" which a haven "safe and convenient for ships of any size" would more especially confer when the Forth and Clyde canal had been completed. It would thus appear that the tendency for an extension of Glasgow interests to the Forth had undergone considerable development since Defoe wrote of it in his "Tour."

As regards the benefits which, by 1785, had already been conferred on Glasgow by the extension thereto, in 1777, of the still incomplete canal, John Knox declared in his "View of the British Empire" that they "almost exceed credibility." During the scarcity of 1782-3 the grain carried to Glasgow by means of the canal from England, Germany and Danzig (at that date a free city under Poland) prevented, he declared, a famine and saved the lives of thousands. Thanks, again, to the canal, the trade between Glasgow and London, "at all times considerable," was being carried on "with great ease and facility." Like benefits were, on the completion of the canal, expected to extend to the populous towns of Paisley, Greenock, Port Glasgow and the whole western division of Scotland. "The inhabitants of both sides of the Kingdom, hitherto estranged from one another, will," he predicted, "drop their local prejudices and become one people, trafficking and bartering with one another for their mutual advantage." In his "History of Civilisation" Buckle wrote concerning the Forth and Clyde Canal:—

In 1768 the great work was fairly begun; and the first step was taken towards what, in a material point of view, was an enterprise of great importance, but, in a social and intellectual point of view, was of still superior value, inasmuch as, by supplying a cheap and easy transit through the heart of the most populous part of Scotland, it had a direct tendency to make different districts and different places feel that each had need of others, and thus encouraging the notion that all belonged to one common scheme, it assisted in diminishing local prejudice and assuaging local jealousy; while, in the same proportion, by enticing men to move out of the narrow circle in which they had habitually lived, it prepared them for a certain enlargement of mind, which is the natural consequence of seeing affairs under

various aspects, and which is never found in any country in which the means of travelling are either very hazardous or very expensive.

So far, however, as the Company of Proprietors were concerned, there was no prospect of financial success for them until the undertaking had been completed for its entire course. Between 1773 and 1789 the increase in the revenue was only from £4,000 to £6,986. In July, 1790, came the extension to the Clyde at Bowling, followed, in October, 1791, by the junction of the Glasgow branch with the Monkland Canal.

INCREASING REVENUE.

These two events had a marked effect on the fortunes of the company. The revenue for 1790 had been no more than £8,000. In 1795 it rose to £13,500, in 1798 it stood at £22,000, and in 1814 it was £48,071.

Having regard to these encouraging financial developments, and desirous of becoming independent of the Government restrictions which had followed the concession of the loan made to them in the time of their adversity, the company sought for authority to repay the £50,000 borrowed from the Trustees of the Forfeited Estates Fund, in order that the control of the canal might thenceforward remain solely in their own hands. The adoption of this course was approved by Parliament, and in 1799 there was passed an Act (39 Geo. III, cap. 71) which set forth that the company had now completed the Forth and Clyde Navigation, "whereby a safe and easy communication is opened from the East to the West sea," and that they were desirous to repay, in three annual instalments, the £50,000 which had been advanced to them, with interest on the respective sums at the rate of 5 per cent. per annum. The Act, which sanctioned this arrangement, went on to say that, from the time the company began the work, they had received no return in the way either of interest or dividends on the capital raised; that over and above this amount, together with the aforesaid loan of £50,000, they had expended on the canal all the money arising from rates and dues received on the navigation, the sum total of all these various items being £421,525, and that, "whereas it is just that the said proprietors should receive reasonable and sufficient indemnification for the heavy loss they have sustained in completing this great undertaking," it was enacted that they should no longer be restrained, as they had previously been, from paying more than 10 per cent. per annum upon the capital stock of the company, that such capital stock should now be declared to amount to the said sum of £421,525, and that the proprietors should be entitled to receive dividends on this amount proportionately. The £421,525, divided by 1,297, the number of the shares of stock, made each share of the value of £325.

At Martinmas, 1800, a first dividend at the rate of £10 per cent. per share per annum on the capital stock as thus determined was paid. In 1801 the dividend was increased to £10 11s. 4d. per cent., in 1814 to £15, and in 1815 to £20.

A DOMESTIC EPISODE.

Meanwhile there had been developed among certain of the proprietors of the undertaking a feeling of discontent which was to reach a crisis in the years 1815 and 1816 and lead to some important changes.

Under the Company's original Act (1768), their first meeting was to be held at the St. Alban's Tavern, in London, and their subsequent annual meetings were also to be held in London (where the head offices were set up), supplemented by quarterly general meetings in Edinburgh. Experience showed, however, that the Edinburgh meetings would not in some instances follow out the resolutions of the meetings in London, and in 1787 the company obtained a further Act which laid down that the general meetings of the proprietors should, in future, be held in "London or Westminster, and not elsewhere." It was afterwards explained that this Act had been sought for, partly because it was thought that the meetings should be free of all local influence or prejudice, and partly because most of the proprietors were either themselves English or resided much in London. The Act also provided for the appointment of twelve proprietors as a Committee of Management to take charge of affairs in Scotland. This arrangement, in turn, was found to be unsatisfactory, and another Act, obtained in 1806, authorized the proprietors at their general meetings in London to elect a Governor and a Council of seven, with power to nominate three of their number as a committee for managing affairs in Scotland. It was claimed for this alteration that certain inconveniences previously experienced were avoided, that the management became more concentrated and the responsibility less divided, while "every opportunity for local jobbing was removed."

The question as to the domicile of the company had already aroused much discontent among shareholders resident in Scotland, and more especially in Glasgow, on the ground that the effect of the Act of 1806 had been to put the management of the canal in the hands of the Governor, Lord Dundas, and a few of his friends and connections, other proprietors who were unable to attend the general meetings in London being deprived of such share in the control as it was considered they should be able to exercise. But this discontent became acute when the Dundas party proposed to carry out certain improvements at the eastern end of the canal—including a new entrance lock, a basin, a ship canal to Grangemouth, a wet dock with locks and a bank and towing path to the mouth of the Carron. The cost of all these works had been estimated by Rennie at £125,511, and it was proposed to expend £23,000 on a first instalment of the said programme, the company then having this amount at their disposal in the Bank of Scotland. The objecting proprietors contended that, although a great harbour at Grangemouth might be of some advantage to the public and of great advantage to the proprietor (Lord Dundas) on whose estate it was proposed that the harbour should be made, it would be of little or no advantage to the canal company as a mercantile concern. The outlay, it was declared, would be a dead loss to the com-

pany, there would be no increase in dividends for another thirty years, while, under the fundamental constitution of the company, the profits should be divided in full among the shareholders, who had already had to wait so long a time for any return on their investment.

To these criticisms it was replied that the carrying out of the proposed new works was essential to the making of adequate provision for the rapidly increasing trade; that Lord Dundas had no private interests to serve apart from those of the company, and that he was influenced solely by a desire to promote the prosperity of the canal undertaking. When, however, the objections to the spending on the new works of the balance in hand were raised, the general meeting in London passed a resolution to the effect that the funds then in the Scottish banks should be withdrawn and invested, in London, in Government securities.

This proposal brought up afresh the question of domicile, and in July, 1815, proceedings against the company were taken in the Second Division of the Court of Session by a Committee appointed for the purpose by holders of 488 shares. In the legal process thus begun the "complainers" and those who "concurred" with them in the procedure taken mainly belonged to Glasgow. "Memorials" presented on each side to the Court of Session in the suit of "Kirkman Finlay, Esq., M.P., and others, against the Company of Proprietors of the Forth and Clyde Navigation," were followed by a flood of pamphlets, including a "Report" of the said committee, signed by Mr. Henry Monteith, Lord Provost of Glasgow, and Mr. Robert Grahame and Mr. James Hill, "writers" (attorneys) of Glasgow; a "State of Facts and Observations relative to the affairs of the Forth and Clyde Navigation, submitted by the Governor and Council to the whole body of Proprietors"; an "Answer" thereto by the same three representatives of the "complainers" as before; "Observations" by the Company on the "Answer," and a "Reply" by the committee to the "Observations."

Finally, at the general meeting of the proprietors held at the British Coffee House, Cockspur Street, London, on March 20th, 1816, Lord Dundas reported that, in consequence of the legal proceedings which had been taken against the company, the Governor and Council would not carry into effect the resolutions previously passed in favour of the proposed improvements and of fresh legislation for securing an extension of the company's powers. A dividend of £25 per share was declared—the value of the £100 shares being raised to £500, in consequence—and Lord Dundas (who had been the leading spirit in the canal undertaking from the start), the Earl of Morton, the Earl of Breadalbane, Sir Charles Edmonstone, and Mr. Archibald Speirs (members of the Council) resigned office, announcing their intention of taking no further part in the management. Mr. Kirkman Finlay was thereupon appointed Governor in place of Lord Dundas, a new Council was elected, and the resolutions passed at the previous meeting in respect to new works, fresh legislation and the transfer of capital from Scotland to London were rescinded. The new Governor and Council were authorized to borrow money for the

carrying out of such works already authorized by Act of Parliament as they considered necessary ; it was decided to take measures to put an end as soon as possible to the still pending law suit, and the thanks of the meeting were accorded to the Lord Provost of Glasgow and to Mr. Robert Grahame and Mr. James Hill for the part they had taken in the movement.¹

Glasgow thus scored a complete success—for the time being ; though it was not long before the declarations of the late Governor and Council as to the need for making further provision at the eastern terminus for the steadily increasing traffic were found to have been thoroughly justified, notwithstanding the short-sightedness of those by whom the policy of expansion and development had been temporarily defeated, mainly in the interest of higher dividends.

REASONS FOR THE CANAL'S SUCCESS.

The success now attained was to be attributed, primarily, to the fact that, since the opening of the canal for its full extent, the trade and commerce of the west of Scotland, and of Glasgow in particular, had increased to an extraordinary degree. There are suggestions, however, that the Company of Proprietors of the Forth and Clyde Navigation, like so many other canal companies in the pre-railway days, sought to exploit the advantages of their position by charging altogether excessive rates to the traders who might at that time have no other practicable means of transport open to them. Thus, in a pamphlet published in 1817, it is related that at a meeting of the Convenery of the Trades of Leith, held in December, 1816, in regard to the then projected "branch" of the Forth and Clyde Canal to Edinburgh, a resolution was passed declaring that such branch seemed chiefly intended by the projectors to be subservient to the interests of the Forth and Clyde Navigation—in which, it was understood, those projectors had large interests—and to strengthen and confirm "the grievous monopoly at present enjoyed by that company, whose rates are already most exorbitant and only limited by the rates of land carriage, with which they are in many instances equally high, thereby defeating in a great measure the chief purpose a canal should answer to the public, viz., a low rate of carriage."

Whatever the justification for this complaint, there is no doubt that the canal company added considerably to their revenue by the conveyance of passengers.

PASSENGER TRAFFIC.

After the canal had been opened through to Glasgow, the company, in 1783, built two track boats with the view both of conducting, on their own account, a regular goods service, three times a week, between Glasgow and Grangemouth (for Leith), and of encouraging other persons to follow their example. A small cabin was provided for passengers, but the boats,

¹ The various documents relating to the course of events here detailed will be found in a volume of pamphlets (4°), entitled "Forth and Clyde and Union Canals, and Solway Fisheries" in the Mitchell Library, Glasgow. See also Bibliography, in the Appendix.

drawn by horses at a walking pace, were very slow, and offered little convenience; though the innovation aroused much public interest.

In 1788 there was published at Paisley, by James Maxwell, "Poet in Paisley," a small book of verses, called "The Great Canal; or The Forth and Clyde Navigation. A Poem, Descriptive of that useful and extensive Undertaking. With pertinent Remarks and Observations thereon and on the Country adjacent." The poem was divided into four sections—(1) "By way of Introduction, giving a general sketch of this Canal"; (2) "Of the Tack Boats"; (3) "Of joining the Great and Monkland Canals together and carrying the Navigation into Clyde across the river Kelvin, etc."; (4) "Of the Utility of this Grand Canal." Concerning the track boats, erroneously described by him as "tack" boats, the Paisley Poet said:—

LO, here's two vessels built with good design,
 Large and substantial, fitted out right fine:
 To carry passengers on this Canal,
 Or any other goods when haste may call;
 One to go east, another to go west,
 Which way soever suits the purpose best.
 Here passengers with cheerfulness may go
 On board hereof, above deck or below.
 A pleasant passage they may here enjoy,
 Divest of danger, void of all annoy;
 For here a cabin in each end is found,
 That doth with all conveniences abound.
 One in the head, for ladies nine or ten,
 Another in the stern, for gentlemen,
 With fires and tables, seats to sit at ease;
 They may regale themselves with what they please.
 For all utensils here are at command,
 To eat and drink whate'er they have at hand.
 The ladies here may freely drink their tea,
 And take their chat without a captious plea;
 The gentlemen may also take their ease,
 And take their glass of anything they please—
 Amuse themselves with books or conversation,
 Or any thing that suits their inclination.
 Nor wind nor weather need disturb their rest,
 Or raise a fear of danger in their breast.
 Here they may sit at their own heart's desire,
 As safe as if at their own parlour fire.
 Nor wind nor weather makes the vessel reel,
 Nor can they any agitation feel,
 Altho' a storm; and if the day be fair,
 Then may they walk on deck and take the air,
 And feast their eyes with objects far and near,
 Which plainly will before their eyes appear.

The poem concludes:—

Heav'n bless them all who did this work begin,
 And all who lent a helping hand herein,
 May heav'nly blessings on their heads descend,
 And on their race till Time itself shall end.

About 5,000 passengers a year were carried. The tonnage rates charged for goods were—from sea to sea, 5s. 10d.; between Grangemouth and Glasgow, 3s. 10d.; between Bowling and Glasgow, 2s.

So inconvenient and slow was this "mixed" service that the company built three boats, the *Margaret*, the *Charlotte* and the *Star*, for passengers only. There was now a daily service, and the boats, drawn each by two horses, did the journey of twenty-five miles between Lock 16 (Falkirk) and Port Dundas in five and a half hours. The cabin fare was 4s., and steerage passengers paid 2s. The results were so encouraging that the company were disposed to see if they could not do still better. In 1809, accordingly, they put on the *Rapid*, the first of their "swift" boats (known south of the Tweed as "fly" boats), which, also designed exclusively for passengers, became a great feature in Scottish travel in the pre-railway days.

In his "Account of the Forth and Clyde Navigation," Hopkirk says of these boats that they were generally 66 ft. long, 10½ ft. wide, and drew from 2½ ft. to 3 ft. water. They provided both cabin and steerage accommodation. The cabin was "elegantly fitted up" and supplied with newspapers, books, backgammon, tables, etc. There was, also, what Hopkirk calls "an eating room," in which breakfast and dinner were provided "at moderate prices." Wine, ale and porter were supplied, though not spirits. The masters of the vessels had the privilege of catering for the passengers, and each of them employed a steward.

Passengers from Glasgow went to Wyndford Lock, where they could take coach for Stirling and the north, or to Lock 16 (twenty-five miles from Glasgow and two miles west of Falkirk), whence they could take coach for Edinburgh. In 1816 three boat services were run daily in each direction. One boat went through to Grangemouth in the evening, returning the next morning, but the other boats went no further than Falkirk, thus avoiding the delay of passing through the sixteen locks between that town and Grangemouth. As it was, they went through four locks only. One of the boats, known as "the market boat," left Falkirk for Glasgow at 5 o'clock in the morning in order that the country people could get their produce to market in good time. Two coaches started from Edinburgh at 9 a.m. with passengers for the 1.30 p.m. boat for Glasgow, and brought back to Edinburgh passengers who had come by the boat from Glasgow. The single fares between Glasgow and Falkirk were still 4s. cabin and 2s. steerage, and the coach fares between Falkirk and Edinburgh were: inside, 8s.; outside, 6s.

The "swift" passenger boats were so called because they did the journey between Glasgow and Lock 16 in three and a half hours. Two thorough-bred horses were attached to each boat, in tandem fashion. The "driver," attired in scarlet coat, knee breeches and jockey cap, rode on the second horse, urging it forward by the use of spurs while, with a long whip, he encouraged the leader to proceed at its top speed. Contemporary prints show the horses going along the towing-path at a gallop. In order to maintain the said top speed and not to overtask the horses the latter were changed every two miles. Stables—substantial stone

structures—were constructed at this distance apart all along the line of route. They are still standing, but are now used as dwellings.

The skippers of the boats showed their importance, in turn, by wearing tall hats and the cutaway coat favoured by restaurant waiters. This combination of speed and dignity was the more justifiable, perhaps, because for many years the boats conveyed, not only passengers, but the mails for Edinburgh, Stirling and the North of Scotland.

Such was the popularity to which the boats attained that by 1814 the number of passengers had increased ten-fold, as many as 2,000 frequently making use of them between Port Dundas and Lock No. 16 in a single week. A writer of this period describes the boats as "cleaner than any inn in Scotland," and he tells how the passengers were sheltered from cold and rain in the cabins, and from the heat of the sun by awnings over the deck. In the circumstances, it is not surprising that preference should have been given to the boats over the stage coaches. So agreeable, in fact, was the voyage along the canal that newly-married Scottish couples of limited means were accustomed to indulge in it for their honeymoon trip.

The total number of passengers conveyed on the Forth and Clyde Canal in 1812 was 44,000; in 1813 it rose to 64,000; in 1814 to 75,000; in 1815 to 85,368, and so on in subsequent years.

Following on the opening (1822) of the Edinburgh and Glasgow Union Canal,¹ establishing a waterway connection between Edinburgh and Lock 16 of the Forth and Clyde Canal, a further great impetus was given to the passenger traffic. An enterprising publisher in Edinburgh thereupon brought out, in 1823, a guide-book of 32 pages which he called "A Companion for Canal Passengers betwixt Edinburgh and Glasgow, giving a complete account of all the interesting objects that are seen along the lines of the two canals; such as towns, villages, gentlemen's seats, works of art, ancient structures and scenes of former wars; likewise an interesting account of the beautiful scenery that is discried on the shores of the Forth, the Clyde and the distant Highland Mountains, to which is added a table of References for the information of Passengers from the West."

There had already been issued at Glasgow, in 1820, a handbook, entitled "The Steamboat Companion and Strangers' Guide to the Western Islands and the Highlands of Scotland," and in 1825 a second edition of this work was published, giving a description alike of the Forth and Clyde Canal and of the Edinburgh and Glasgow Union Canal.

In 1831 an independent company started a service of night boats between Glasgow and Edinburgh. These boats, known locally as "hoolets" (*Anglicè*, "owls"), afforded sleeping accommodation, and were allowed to supply their patrons with spirits, in addition to other beverages.

By 1836 the increase in the passenger traffic on the Forth and Clyde Navigation—apart from the substantial growth of the goods and mineral

¹ See Chapter VIII.

traffic—had attained such proportions that the number then being carried was close on 200,000 per annum.¹

How the services were being run in 1841—through canal and coach tickets being, apparently, issued from Glasgow to various inland destinations—is shown by the following copy of a handbill of the period :—

SWIFT PASSAGE BOATS.

THE FORTH and CLYDE
CANAL SWIFT PASSAGE
BOATS start from Port-Dundas,
during the SUMMER MONTHS, as
follows :—

To EDINBURGH, at 7 and 9
Morning, and 12 noon.

Fares, 6s. and 4s.

To STIRLING, at 7 and 9 Morning,
12 Noon, and 4½ Afternoon.

Fares, 4s. 6d. and 2s. 6d.

To ALLOA at 4½ Afternoon.

Fares, 5s. and 3s.

To FALKIRK, at 7 and 9 Morning,
12 Noon, and 4½ Afternoon.

Fares, 3s. and 2s.

To PERTH, by CRIEFF, at 9
Morning.

Fares, 12s. and 8s. 6d.

To KIRKALDY, at 9 Morning.

Fares 12s. and 8s.

☞ The Boats will be Started from
Port-Dundas precisely at the hour,
taking the time from the Tron Church
Clock.

Canal Office, 1st May, 1841.

According to the "Edinburgh Encyclopædia" (1830), the annual revenue of the Forth and Clyde Navigation at that time varied between £40,000 and £50,000. In 1837 a dividend of £30 per annum was paid. In 1840 the value of the £100 share was £650. But the outlook for the future was now darkening on account of the advent of railway competition.

EDINBURGH AND GLASGOW RAILWAY.

For some years prior to 1825 the construction of an alternative direct route for cross-country traffic, either by water or by rail, between New-

¹ On the occasion of some papers on "Steam Power on Canals" being read at the Institution of Civil Engineers, November 13th, 1866 (see *Proceedings*, Vol. XXVI, 1867), Mr. Mallett referred to some "fly boats" put on the Scottish Canals by Mr. Hunter about the year 1836, and said they were capable of carrying sixty passengers, and were towed by two horses. Two years later Mr. Mallett was instrumental in getting similar boats adopted in Ireland on the Grand and Royal Irish Canals. These were drawn by either two or three horses and they went at the rate of about eight miles an hour. Mr. Mallett added :—"The distress to the horses was considerable owing to the wave of translation, which travelled along with the boat when at full speed, passing on a-head when the boat pulled up, and so requiring to be re-established when full speed was restored."

castle and Carlisle had been under consideration, and a decision was then arrived at in favour of a railway. It was not, however, until 1830 that a start could be made with the work, and, although separate sections had been opened in the interval, the line as a whole was not completed until the summer of 1838. The Company of Proprietors of the Forth and Clyde Navigation now began to recognize the existence of a rival in the transport of traffic across country from coast to coast, and they showed their appreciation of the position by making a substantial reduction in their own charges. The competition of the Newcastle and Carlisle Railway became still stronger on the amalgamation of that line with the North Eastern Railway in 1862.¹

Much more serious, however, for the Scottish canal traffic was the competition which came, in 1842, with the opening of the Edinburgh and Glasgow Railway, a direct line being provided between those two cities, with a branch to Falkirk. At first the Committee of Management of the Forth and Clyde Navigation affected to despise the new venture. Whilst, in fact, the scheme was still only projected, they issued a statement to the canal shareholders in which they said :—

The establishment of a railroad between Edinburgh and Glasgow on the principle of that now in active operation between Manchester and Liverpool can never be attempted with any hope of profit or will ever be undertaken by those who are acquainted with the cost of such enterprises.

Very soon, however, after the opening of the new line, which paralleled the Forth and Clyde Navigation for the greater part of its length, the canal company found that their prosperity had received a serious blow.

Practically the whole of the through passenger traffic left the canal for the railway, while for the goods and mineral traffic there began a rivalry which quickly developed into a tariff war. At first both parties lost heavily. Then an agreement was arrived at which not only fixed the rates to be charged on canal and railway respectively but apportioned the traffic between them according to whether it went in an eastward or a westward direction. The superiority of the railway speedily asserted itself, and the decline in the canal company's revenue continued at an accelerated pace as more railways were constructed and, also, as the collieries adjoining or near to the banks of the canal gradually became exhausted.

THE CANAL COMPANY'S ENTERPRISE.

The company nevertheless showed a good deal of enterprise in their management of the canal, and they embarked on a number of new developments with a view to increasing the efficiency of its operation and the proportions of its patronage.

An experiment with mechanical haulage had already been made by them in 1839. Rails were laid along the banks of the canal for a short

¹ Some interesting notes on " Early Days of the Newcastle and Carlisle Railway," by Mr. R. D. Burn, who had been associated with it since 1859, will be found in " The North Eastern Railway Magazine " for May, 1913.

distance on the summit level, and on these there was placed a locomotive which towed a string of vessels ; but the system was regarded as too expensive—the more so as it dealt with only a small part of the haulage—and it was abandoned accordingly.

Much greater success was obtained in the application of steam power, for the purposes of propulsion, to the canal vessels themselves.

Proposals in this direction were made in 1855 by the engineer of the Forth and Clyde Navigation at that date—Mr. James Milne. His idea was to fit small high-pressure engines and screw-propellers on to the ordinary goods lighters then being towed by horses—the engines being placed as close to the stern as possible—thus converting each vessel into a self-contained steam lighter and securing various advantages thereby, including that of dispensing with horse traction. Mr. Milne had, however, a preliminary difficulty. The Committee of Management were at that time prejudiced against any further attempt to introduce steam power on the canal by reason of what they regarded as the failure of the experiments made with Symington's boat in 1789, with the *Charlotte Dundas* in 1802, and with other vessels subsequently. The fear in these directions had been that the wash from steam-driven paddle-boats would damage the banks of the navigation ; but with the use of a screw-propeller the same degree of trouble in regard to wash would not arise, while in the case of a canal of such exceptional width and depth as the Forth and Clyde, the water would have free means of escaping from the sides of the boat as well as from below. There would thus be less probability of such a wave from the boat as might exercise destructive action on the banks than there would be in the case of a canal that was both narrow and shallow.

The committee appear to have been at last converted to this view ; but they still entertained the idea that any boat on which the high-pressure engine and propeller were fitted should be further utilized in towing a couple of ordinary boats—the engine being strengthened accordingly—in order that the steam power could be employed to the best advantage. Here, again, however, they were found to be in the wrong.

Steam haulage by means of paddle tug-boats had been adopted on the Aire and Calder Navigation in 1836, and the paddle-wheel was succeeded there by the screw-propeller in 1853 ; but the Aire and Calder is comparatively free from locks, whereas on the Forth and Clyde Navigation a steam lighter, acting as a tug, and going from one end of the canal to the other, would require to pass, with its fleet, through thirty-nine locks, involving, not only much delay for the steam lighter, but much possible interruption of other traffic on the waterway. The Company of Proprietors were not themselves carriers, except to a limited extent in respect to general goods, and, apart from the probable difficulty, first in collecting and then in towing the various descriptions of craft using the canal, there was the prospect that traders who did not take advantage of the proposed system would have good cause for complaint at the delays

occurring when their own boats had to wait at the locks until the canal company's fleet or fleets had passed through.

For these reasons, Mr. Milne did not favour a resort to tug-boats or their equivalent on the Forth and Clyde, and the idea was, in fact, abandoned by the company after the trial trip, in 1856, of the first lighter on the canal—the *Thomas*—to which engine and propeller were fitted. Otherwise the experiment then made was a complete success. The *Thomas*, which carried 80 tons of cargo, was thenceforward regularly used for the general goods traffic worked by the canal company themselves. Mr. Milne applied the same principle to a luggage boat, carrying 35 tons, to an ice-breaker, to "scows" (mineral barges), and, also, to masted lighters carrying 120 tons, and used either on the canal or for coasting traffic. By 1866 there were on the Forth and Clyde Navigation and the Monkland Canal, then belonging to the same company, and being used in connection therewith, no fewer than seventy steam vessels at work either on those waterways or operating between them and ports on the coast.¹

So far did the same principle come into vogue that, under normal pre-war conditions, about 70 per cent. of the total traffic on the Forth and Clyde Navigation was conducted by means of steam lighters, the remainder going by horse haulage. No towing, however, either by steam lighters or by tugs, is done.

In further illustration of the spirit of progress and enterprise which marked the operation of the Forth and Clyde Navigation by its original Company of Proprietors, the fact might be mentioned that when the canal was opened throughout, in 1790, the harbour into which it had its eastern outlet, at Grangemouth, was no more than a creek off the River Carron which was available only for vessels of a light draught, and was practically dry at low water. With a view to developing the traffic on the canal, the company improved the harbour and banked the sides of the Carron; but difficulties were still experienced on account of the increasing size of the vessels using the port. In 1841, accordingly, they got authority to construct a wet dock four and a half acres in extent, and this was opened for transhipment traffic in 1843. In order to meet the need for still more accommodation, another dock, three and a half acres in extent, was added in 1859. Some timber basins were also provided. Then the company found it desirable to construct a branch line of railway linking up the canal and the docks with the railway systems of the country, and enabling them to keep the traffic moving when the canal was blocked with ice. This line, opened in 1860, and known as the Grangemouth Branch Railway, established direct connection between Grangemouth and the Edinburgh and Glasgow Railway at Grahamstown (Falkirk).

In 1842 the company obtained Parliamentary powers for taking over the Forth and Cart Canal—a diminutive waterway, three quarters of a mile in length and 5 ft. in depth, which, under an Act obtained in 1836, had been cut from the Forth and Clyde Navigation near Clydebank to a

¹ "Steam Power on Canals," by James Milne. *Proceedings of the Institution of Civil Engineers*, Vol. XXVI. London, 1867.

point on the Clyde opposite the junction of the river Cart (Renfrewshire), with the Clyde, thus giving continuous navigation from the Forth and Clyde Navigation to the towns of Renfrew and Paisley, though it was very little used.¹

Of much greater importance was the absorption by the Forth and Clyde Navigation, in 1846, of all the properties comprised in the Monkland Navigation, including the Drumpeller Railway. (See Chapter VII.)

The company also owned the eastern half of Bowling harbour, on the river Clyde—acquired and developed to afford facilities for the transshipment of iron ore, limestone, etc., from steamers into lighters going through the canal.

Although, too, the greater part of the through passenger traffic had left the canal, the company continued to run passenger boats for local traffic or pleasure trips down to 1852, when they transferred this branch of the business to a Mr. Taylor. The passenger boats were drawn by horses until 1860. A screw steamer for passengers, the *Rockvilla Castle*, was then put on, and was purchased a few years later by Mr. George Aitkin, who ran her till 1880. In 1892 a fleet of pleasure steamers, running from and to Port Dundas, was put on by James Aitken and Co., Ltd., of Kirkintilloch, and these steamers—weather permitting—are still making daily trips to various points on the canal, affording delightful excursions which are well patronized by Glasgow's busy workers.

¹ The Forth and Cart Canal was afterwards deprived of nearly the whole of its traffic by the opening, in 1882, of the Glasgow, Yoker and Clydebank Railway. In 1893, when the traffic averaged about one boat per week, the canal was closed down, following on the construction of the Lanarkshire and Dumbartonshire Railway, part of that line being built along the old canal bed.

CHAPTER VI.

RAILWAY OWNERSHIP.

IN 1867 the Forth and Clyde Navigation became the property of the Caledonian Railway Company. Almost concurrently therewith, the decline in traffic which had then already set in proceeded at a continuously increasing rate, although this fact was in no way attributable to the policy of the railway company, and was, indeed, directly opposed thereto.

The reasons why the Caledonian acquired the canal and the causes for the subsequent greater falling off in traffic are matters of exceptional interest and significance from the point of view of those oft-recurring controversies as to the relations of railways and canals and of the economic aspects of canal transport in general.

According to the popular theory, railway companies obtained possession of canals in order to "strangle" them and ensure the transfer of the traffic to their own lines; but no one acquainted with the facts of the case could possibly make this assertion in regard to the Caledonian Railway Company and the Forth and Clyde Navigation.

WHY THE CALEDONIAN ACQUIRED THE CANAL.

Down to 1865, the Caledonian was a railway of very limited extent. Beginning at Carlisle, on the south, it went no further than Glasgow and Greenock on the west, Edinburgh on the east, and Greenhill on the north. At Greenhill, five miles south of Falkirk, it joined the Scottish Central Railway. The years 1865, 1866 and 1867 became, however, the amalgamation period of the Caledonian, introducing in a more active form than before a policy which was to continue until the Caledonian system constituted an aggregation of forty-one previously separate and distinct railways, owning or operating over 1,100 miles of line.

One of the absorptions brought about in 1865 was that of the Scottish Central Railway Company, the effect of which was to make the Caledonian owners of lines as far north as Perth, Dundee and Newtyle. In the following year the Caledonian took over the Scottish North-Eastern and thus extended their system to Aberdeen.

Meanwhile the North British Railway Company—to which running powers over the Scottish Central lines had been granted—had acquired, in 1865, the undertaking of the Edinburgh and Glasgow Railway Company, of which the lines of the Monkland Railway Company (extending from the port of Bo'ness on the Forth to the Lanarkshire coalfields at Airdrie, etc., and to the Stirlingshire coalfield in the Slamannan district), formed

part. The Caledonian got running powers over the lines between Edinburgh and Glasgow and between Polmont and Larbert Junction, but not over any other of the lines which had belonged to the Edinburgh and Glasgow Company or the lines of the Monkland Railway Company.

Prior to this amalgamation with the Edinburgh and Glasgow, the North British Railway Company's lines did not go further west than Edinburgh. They were now extended to Glasgow, to the Lanarkshire and Stirlingshire coalfields, to Helensburgh and to Loch Lomond. The North British also got access to the ports of Bo'ness on the Forth, to Grangemouth (as workers of the Grangemouth Branch Railway), and to Glasgow and Bowling, on the Clyde.

When the Caledonian Company absorbed the Scottish Central in 1865, they were practically the only railway company serving the large and important coalfields of Lanarkshire; but, while they gained much advantage from the amalgamations they effected and the running powers they acquired, they owned no port or harbour in Scotland except the small and rather shallow tidal harbour of South Alloa, taken over by them from the Scottish Central. With the important extensions brought about in their system, they recognized that it had become necessary for them to obtain control of some port on the east coast where they could dispatch goods to or receive them from the Continent, and whence, also, they could ship to the Continent coal from the Lanarkshire coalfields still chiefly served by them.

The one and only port that would be likely to meet their requirements was considered to be the port of Grangemouth; and negotiations were opened with the Company of Proprietors of the Forth and Clyde Navigation, to whom it belonged. But the port of Grangemouth was not to be purchased apart from the remainder of the undertaking, and the acquiring by the Caledonian Company of the indispensable port thus meant the acquisition by them of the Forth and Clyde Navigation and all the various properties connected therewith. Arrangements were made accordingly between the two companies, and under the Caledonian Railway and Forth and Clyde Navigation Companies Act, 1867, there was transferred to the Caledonian Railway Company the entire undertaking of the canal company, including the Forth and Clyde Canal, the Monkland Canal, the Drumpeller Railway, the Grangemouth Branch Railway, together with all harbours, basins, docks, quays, wharves, etc.

Access by the Caledonian to Grangemouth harbour was further improved by their obtaining running powers over the North British railway between Larbert Junction and Grangemouth Branch Junction. The North British, in turn, were given running powers over the Grangemouth Branch Railway, and, so far as railway traffic was concerned, equal facilities with the Caledonian at Grangemouth. The management of the branch railway and of sidings in connection with the dock was vested in a Joint Committee of the two companies. Provision was also made by the Act for a uniformity of charges on shipping and on traffic carried by rail or canal by either company. It was further stipulated that any

advantage, drawback or other privilege conferred by the Caledonian Company on traders consigning by rail or canal to Grangemouth port should equally apply when the traffic was carried by or over the system of the North British Railway Company.

Under the terms of purchase, the Caledonian Railway Company became bound to guarantee to the Company of Proprietors of the Forth and Clyde Navigation a fixed annuity of £71,333, being $6\frac{1}{4}$ per cent. on the capital of the company. By a later arrangement, the holders of shares in the canal company were paid, instead, 4 per cent. guaranteed Caledonian stock, the value of the shares being so altered that they still brought in the $6\frac{1}{4}$ per cent.

It will thus be seen that the Caledonian Company acquired the Forth and Clyde Navigation, not because they wanted it, but because the purchase of it was an indispensable condition to their gaining possession of Grangemouth Harbour, the control of which they regarded as essential to the further development of their railway system.

INTEREST IN CANAL TRAFFIC.

Having, however, got the canal, the Caledonian Railway Company had a direct interest in securing for it as much traffic as they possibly could. This was so because the greater part of the Forth and Clyde Navigation—and, also, the entire route of the Monkland Canal—was then served by the North British Railway Company alone, and practically all the traffic the Caledonian could obtain for the two waterways was traffic diverted from the lines of their competitors. It is true that the company were not themselves carriers on the canals. Their function was to keep them in proper condition, work the locks and bridges, and collect tolls for traffic put on the canals by traders or contractors who charged their own patrons whatever rates they pleased—or could get—without any arrangement or undertaking in this respect with the owning company. There were, none the less, the best of reasons why the Caledonian Railway Company should make every possible effort to develop the traffic, whether by the maintenance of a high state of efficiency, an increase in the available facilities, or in other ways. This was especially the case in regard to the Forth and Clyde Navigation, on which the company spent every year large sums of money, with the result that it has been kept ever since in a much higher state of efficiency than when it was originally taken over.

In order, for example, to encourage the use of steam lighters and, at the same time, to avoid the washing down of the sides of the waterway, the company had the banks on the tracking-path side between Glasgow and Craigmarloch faced with stone for a distance of eighteen miles. Then the canal has been maintained at a depth of about 9 ft. 6 in. by the keeping of two steam dredgers constantly at work, the quantity of material removed from the waterway averaging close on 25,000 tons per annum. Ice-breakers, propelled by steam and, also, drawn by from fifteen to twenty horses walking along the towing-path, break up the ice in the

canal in times of frost, so that during a period of ten years traffic was not stopped for one single day on account of frost. In fifteen years the traffic was never stopped for any reason whatever for forty-eight hours at a time, except on one occasion when there was a stoppage for nearly four days owing partly to the carrying out of some repairs and partly to works in connection with a line of railway. Traffic is further encouraged by keeping the canal open day and night from 12.5 a.m. on Monday till midnight on Saturday, while, in order to assist traders to compete better with the railways, no charges are imposed by the Caledonian Railway Company in respect to traffic passing through the canal at night.

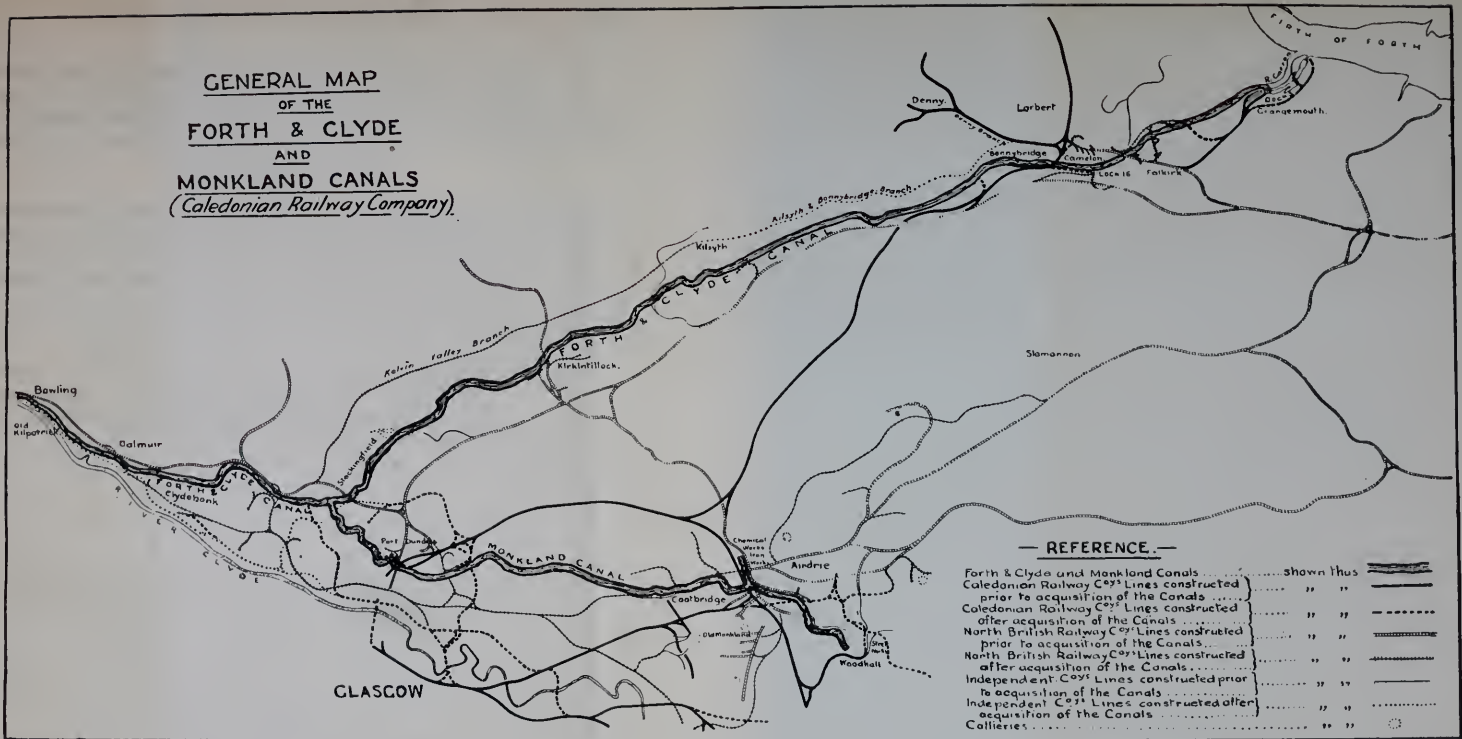
GRANGEMOUTH DOCKS.

Indirectly, also, if not directly, the Forth and Clyde should have benefited from the extensions and improvements effected at Grangemouth Docks.

When these docks were taken over by the Caledonian Railway Company, in 1867, the accommodation consisted of a tidal harbour, two small docks about seven or eight acres in extent, and some timber basins. The tonnage dealt with in that year amounted to 464,000 tons. By 1874 the figure had increased to 759,000 tons. Merchants and traders thereupon began to beg that the company would provide dock accommodation for vessels of a larger type than those which had thereto used the port. The company accordingly acquired powers in 1876 for the construction of a new dock, 20 acres in extent, and for carrying out a scheme for dredging the river Carron (along which any vessel entering the port had to proceed for a distance of two miles from the Forth), to a depth of 25 ft. at high water of ordinary spring tides. The new dock, known as the Carron Dock, was opened June 3rd, 1882, and was an immediate success. The dredging of the Carron was a failure. Much money had been spent, but it was found impossible to maintain a depth of 25 ft. in the river. No sooner had one part been dredged to the required depth than it filled up again. A certain increase in depth was secured by constant dredging, but the 25 ft. was unattainable, and the attempt was abandoned as hopeless.

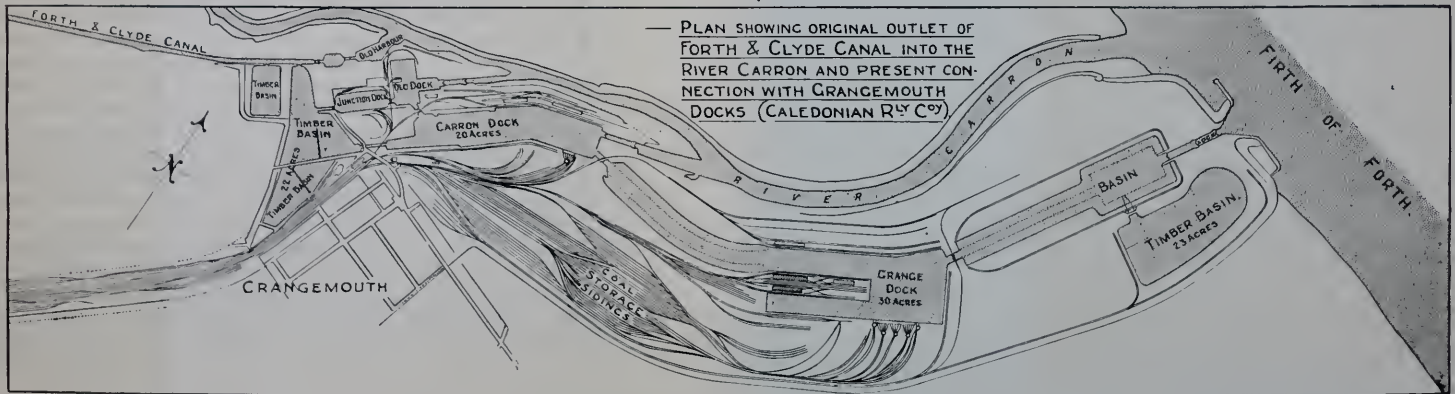
In 1882 the tonnage dealt with at Grangemouth was 858,000. By 1890 the total had risen to 1,760,000 tons, and by 1896 to 2,418,878 tons. Demands for a further increase in dock accommodation then became especially vigorous. What was clearly needed, however, was, not only a new dock but an entrance to it direct from the Firth of Forth in place of the one from the shallow and tortuous Carron. Parliament was once more appealed to; the necessary powers were obtained in 1897, and the works, begun in 1898, were completed in 1906. They consisted of the Grange Dock, 30 acres in extent; a canting dock of 10 acres; a new entrance lock on the south shore of the Firth of Forth; two channels and, adjoining the entrance basin, a timber basin of 23 acres (now being filled in), the total area thus absorbed amounting to about 100 acres. The

**GENERAL MAP
OF THE
FORTH & CLYDE
AND
MONKLAND CANALS
(Caledonian Railway Company)**



— REFERENCE —

Forth & Clyde and Monkland Canals	.....	shown thus	
Caledonian Railway Co's Lines constructed prior to acquisition of the Canals	.....	" "
Caledonian Railway Co's Lines constructed after acquisition of the Canals	.....	" "
North British Railway Co's Lines constructed prior to acquisition of the Canals	.....	" "
North British Railway Co's Lines constructed after acquisition of the Canals	.....	" "
Independent Co's Lines constructed prior to acquisition of the Canals	.....	" "
Independent Co's Lines constructed after acquisition of the Canals	.....	" "
Collieries	.....	" "



sea lock, which, by means of the channels referred to, gives access to all the docks at Grangemouth, is 626 ft. long and 80 ft. wide.

Altogether, since the Caledonian Railway Company acquired the docks in 1867 they have expended nearly £2,000,000 on improvements.

THE TRAFFIC CARRIED.

The traffic on the Forth and Clyde Canal, in normal times, is principally traffic passing either from sea to sea or between intermediate places on the waterway; though, in the former case, inasmuch as the transport facilities offered are restricted to vessels having a capacity of about 100 tons, traffic arriving at Grangemouth in coasting or other sea-going vessels for Glasgow or beyond has to be transhipped into barges before it can pass through the canal. In the said normal times, the traffics consisted mainly of coal, iron-stone, pig-iron, timber, castings, grain, salt, sugar, oil, stones, slates, flour and general merchandise.

Coal from the Kirkintilloch district went principally to Glasgow, Bowling and places either on the Firth of Clyde or in the West Highlands. Pig-iron traffic consisted of pig-iron brought by coasting steamers to Grangemouth and conveyed thence mostly to Glasgow, smaller consignments being for the iron foundries in the Falkirk, Bonnybridge, and Kirkintilloch districts. Timber went mainly from Grangemouth to Falkirk, Glasgow or Bowling, or, in the opposite direction, from Bowling to Glasgow. In addition to the ample facilities provided by them at Grangemouth for the timber traffic there, the company also had extensive timber ponds in Glasgow. The castings traffic was carried from Glasgow, Kirkintilloch, Falkirk and Bonnybridge districts to Grangemouth for shipment. Salt went from Grangemouth to Glasgow, and rock salt from Ireland to Glasgow and destinations on the east coast of Scotland. Sugar, oil and flour, imported into Grangemouth or Leith, went by the canal to Glasgow, and slates and stones from Bowling to Glasgow and elsewhere. Cargoes of general merchandise, transhipped into lighters at Leith, Bo'ness or Grangemouth, passed regularly, through the canal, from Grangemouth to Glasgow, and a daily boat ran between Falkirk and Glasgow with general merchandise, castings, etc.

Having regard alike to the direct interest of the railway company in securing every possible increase in traffic on the Forth and Clyde Navigation, to the efforts made by them in this direction, and to the fact that the improvements carried out in the port of Grangemouth should have provided increased facilities for dealing with traffic of all kinds—facilities so much taken advantage of that the tonnage handled at Grangemouth for the year 1913 amounted to 3,889,944 tons—one might well have assumed that an increase of traffic on the Forth and Clyde Navigation must have followed as a matter of course. The contrary, nevertheless, was the fact, as will be seen from the following figures, which give tonnage and revenue at ten-year intervals from 1868 to 1908, supplemented by those for 1913, the last complete year of normal conditions before the outbreak of war:—

YEAR.	TONNAGE.	REVENUE.
1868	3,022,583	£ 87,145
1878	2,023,233	57,129
1888	1,257,206	44,038
1898	1,028,102	38,281
1908	817,836	34,820
1913	776,731	35,136

The only traffic showing an increase during the period here in question was in regard to through traffic, principally pig-iron and timber carried between Grangemouth and Glasgow, the fall in revenue thus being less marked than the decline in tonnage. The latter was accounted for mainly by the decrease in local or intermediate traffic.

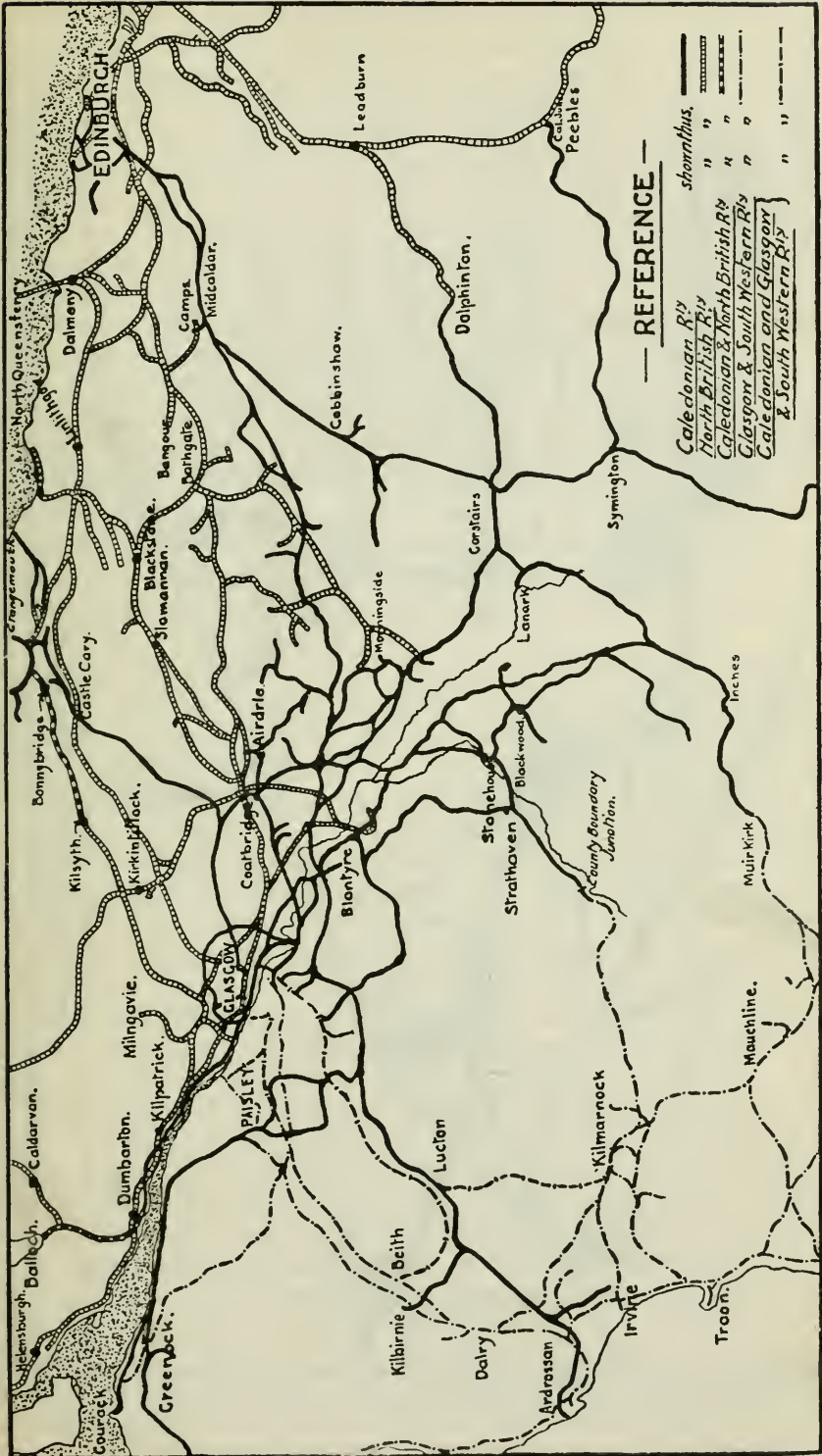
WHY THE CANAL TRAFFIC FELL OFF.

In the evidence he gave before the Royal Commission on Canals and Waterways in 1907 concerning the Forth and Clyde Navigation, the late Mr. R. Millar, then General Manager of the Caledonian Railway Company, attributed the falling off of traffic mainly to three causes—(1) railway competition ; (2) preference of traders for rail rather than water transport, and (3) changes in conditions affecting production or transport in particular trades. These specified causes may here be considered in the light partly of Mr. Millar's evidence and partly of supplementary facts.

RAILWAY COMPETITION.

It has been shown that the period of decadence for the Forth and Clyde Navigation set in with the opening in 1842 of the Edinburgh and Glasgow Railway, which was constructed almost parallel to the waterway for the greater part of its distance.

That keen competition must have followed when the two were in such close proximity was inevitable ; but whilst there were, when the Caledonian acquired possession of the Forth and Clyde Navigation, practically no railways except the Edinburgh and Glasgow in the district through which the canal runs—so that all coal and other traffics from and to such district had perforce to be conveyed by the canal—there was subsequently developed a complete network of railway lines, branches and sidings, the whole district being eventually filled with railways which tapped and diverted at every possible point, and to a very large extent indeed, traffic that would previously have gone by canal. The lines in question were chiefly built by independent companies and afterwards taken over by the North British Railway Company, who are strong competitors of the Caledonian Railway Company and have thus every reason for capturing as much of the canal traffic for themselves as they can, whereas the Caledonian Company, having guaranteed a dividend of $6\frac{1}{2}$ per cent. to the holders of shares in the original Forth and Clyde Navigation Company, have had no interest in diverting traffic from their waterway to their railway.



PRINCIPAL RAILWAY LINES BETWEEN EDINBURGH AND GLASGOW.

How the new lines in question have multiplied and operated to the prejudice of the Forth and Clyde may be illustrated by a few especially significant examples.

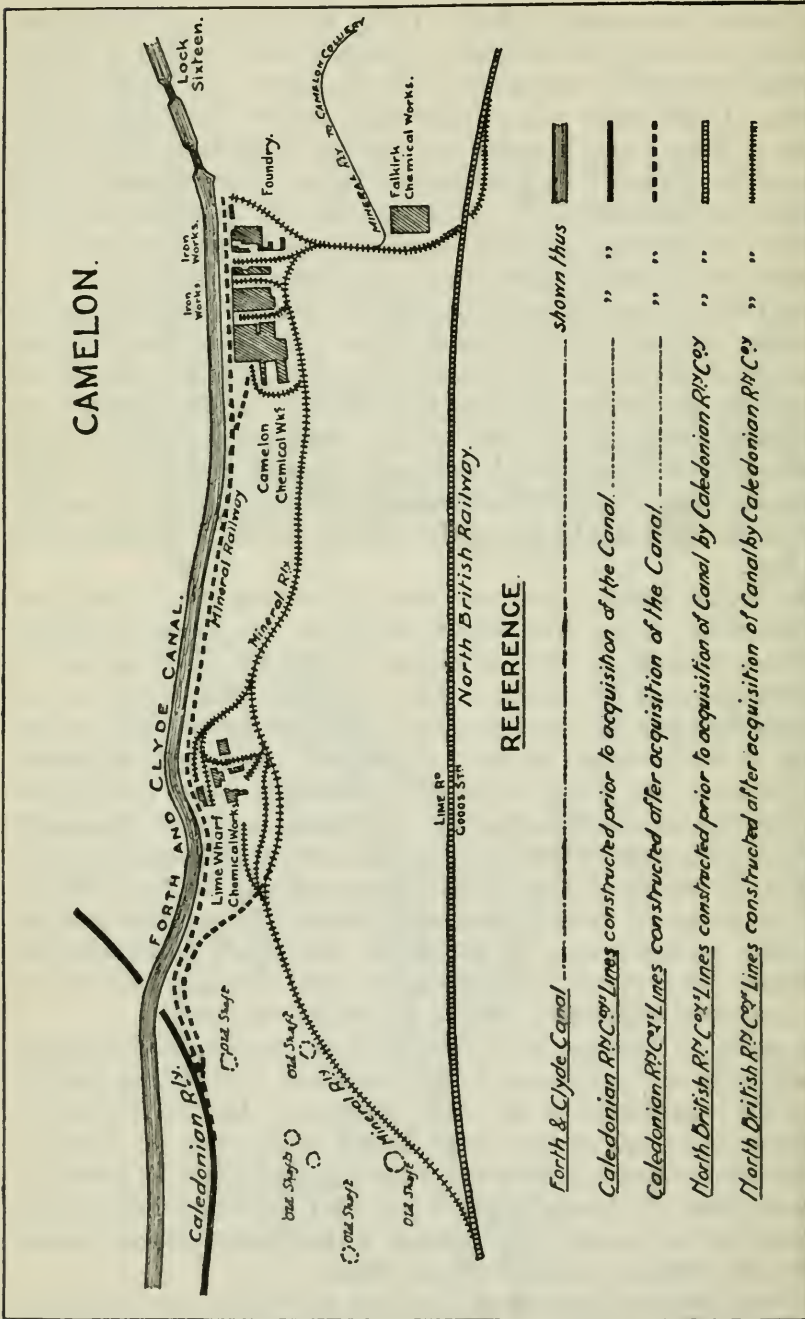
In 1882 there was opened a Kelvin Valley Railway which, built by an independent company, started from a junction with the North British Railway near to Maryhill, on the north-east of Glasgow, and was continued to Kilsyth. In the same year another independent company obtained powers for a Kilsyth and Bonnybridge Railway designed to link up the terminus of the Kelvin Valley Railway with the Denny Branch of the Caledonian, near Bonnybridge. The second line was opened in 1888, and the two, in combination, paralleled the Forth and Clyde Navigation for the greater part of its length on the north—that is, from Glasgow to a point near Larbert—just as the Edinburgh and Glasgow had already done on the south; and they, in turn, absorbed to a further considerable extent traffic on which the canal had hitherto been able to rely. The Kelvin Valley Railway was merged with the North British in 1885, and later on the Caledonian Company—in order to gain some compensation for the traffic certain, in any case, to be abstracted from the canal under these conditions of rivalry—agreed with the North British to take over from the Kilsyth and Bonnybridge Company the working and traffic arrangements of their line.

In the Falkirk district there are, along either side of the Forth and Clyde Navigation, many iron works, foundries, gas works and other industrial establishments which formerly provided the waterway with a considerable amount of traffic. Some of these had been set up immediately alongside the canal in order to be in the best position to take advantage of the transport facilities it afforded. But the Stirlingshire Midland Junction line of the North British Railway passes through the district, crossing the canal on the west, and since about 1880 practically the whole of the important works in question have, notwithstanding their proximity to the canal, obtained direct connection with the North British Railway by means of branch lines and sidings, the pig-iron and the castings they formerly sent by the Forth and Clyde Navigation for shipment now going by rail instead. In the same way they now receive most of their coal supplies by rail in preference to water.

Then, again, at Camelon, near Falkirk, there are some large chemical works, originally set up adjacent to the Forth and Clyde Navigation by reason of the convenience of the water transport; but the Edinburgh and Glasgow main line of the North British passes near to them on the south, and the owners of the works, regarding the railway as preferable to the canal, asked the North British to provide them with branches from the east and the west respectively, together with sidings and spurs coming right into the different sections of the works.

The North British Company did so, and thereupon the Caledonian Company, finding that still more of their water traffic was leaving them in consequence, built, from one of their existing lines crossing the canal on the west, a branch which also served the works concerned, giving them an

alternative railway route, and enabling the Caledonian to carry by rail at least some of the traffic that was being taken from their canal.

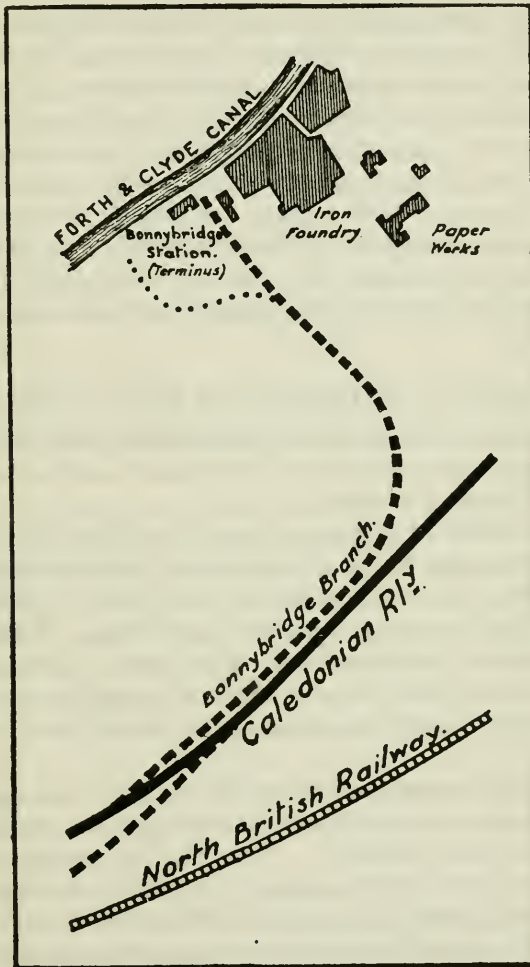


WORKS, WATER AND RAILS AT CAMELON.

When the owners of works on or adjoining the Forth and Clyde Canal at Camelon saw that their neighbours and competitors at Falkirk were getting rail in addition to water connections, they were not content until similar advantages had been conceded to them. Thereupon still more traffic left the canal.

At Bonnybridge are still other foundries which, when the Caledonian acquired the Forth and Clyde Navigation and for some years afterwards,

were dependent upon it for their transport. The traders there were in competition with the works in the Falkirk district, and, shortly after the linking up of the latter with the North British system, they represented to the Caledonian Company that they were at a disadvantage in having to depend on water transport. They asked that they should be provided



WHY THE BONNYBRIDGE BRANCH WAS BUILT.

At Bonnybridge a situation arose similar to that at Falkirk and Camelon; but in this instance it was the Caledonian Company who had to build the branch line that was to compete with their own canal.

with a rail connection as well. Thereupon the Caledonian built their Bonnybridge Branch, opened in 1886, and the canal lost still more of its former patronage.

Traffic from the Meiklehill collieries, on the east of Kirkintilloch, used to go by a branch canal to the Forth and Clyde Navigation; but there came a time when it all went to destination by rail and the branch

canal had to be closed. The Glasgow, Yoker and Clydebank Railway (opened 1882) absorbed in the district it served most of the traffic from chemical works and shipbuilding yards which had formerly gone by the Forth and Clyde Navigation, and it was under like conditions that the Forth and Cart Canal had to be closed in 1893.

A number of other examples could be given ; but enough has been said to show how it was that, since the Forth and Clyde Navigation was acquired by the Caledonian Railway Company, the traffic thereon has steadily declined, not because of any shortcomings in the canal itself or in its maintenance (as shown by what the Royal Commission on Canals and Waterways said concerning it), and not from any lack of direct interest on the part of the company in getting all the water traffic they could, but by reason of new railway lines built, or increased facilities for transport by rail provided, by their competitors, while the Caledonian in turn have, as at Camelon, for example, been placed in the curious position of being forced, as railway owners, to compete with themselves, as canal owners.

PREFERENCE OF TRADERS FOR RAIL TRANSPORT.

Another factor which has had a powerful effect in driving traffic away from the canal has been the altered position of works in respect to the transport conditions of to-day.

Formerly all works of any importance were placed alongside canals in order that they might be in a convenient position for receiving and dispatching traffic. In this respect there has been a complete change in the situation following on the expansion of railways. Works can now be put down anywhere and connected with public railways under such conditions that they obtain conveniences for dispatch, etc., even greater than those which would be afforded by immediate proximity to a canal.

These conditions are especially found in regard to coal supply. Traders with works situated on a canal who obtain their coal supplies by water are restricted in their markets. They can buy their coal only from collieries which are served by the canal ; whereas traders who use railways for the transport of their coal supplies have the run of all the markets in the country. This consideration has, in itself, been a powerful factor in the reduction of traffic on canals.

If, again, the works are not actually on the canal banks, coal sent to them by canal will have to be carted from the canal dock or basin ; whereas if the coal is sent by rail, the cost of cartage will be saved by the forwarding of the coal, not only right into the works, but, it may be, to the particular furnace or spot in the works where it will be used. This advantage from rail transport may be gained even when the works are actually alongside the waterway, since the coal brought by a boat will have to be, first, thrown out of the boat on to the higher level of the wharf, and, next, wheeled or carted to the spot where it will be used, additional labour being necessary and additional expense being incurred as compared

with the taking of the coal all the way from colliery to final destination, and then unloading from a higher to a lower level.

One firm of traders have pits at the western end of the Forth and Clyde Navigation and iron works at the eastern end. They also have their own private railways from the pits to the canal and from the canal to their works. Here, therefore, the conditions would appear to be absolutely ideal for the consignment of coal by water from pits to works. Yet the firm in question have abandoned the canal in favour of sending the coal all the way by rail. They find that they save in terminal expenses, that less labour and less handling are required, and that, as the result of having all the coal brought right into the works by rail, they make certain of having always available a good supply of empty wagons for the dispatch of their consignments.

To-day comparatively little coal is carried on the Forth and Clyde Navigation save for that which is taken to works on the canal itself. Formerly, too, a considerable quantity of coal was shipped on the canal in vessels which served places in the Western Highlands or Islands that could not be reached by rail ; but the traders now find it preferable to buy their coal on a wider market, have it sent by rail to Glasgow and put on board there, instead of depending on collieries served by the canal.

Much that has here been said concerning coal supplies and canal transport is no less true as regards other raw materials for industrial establishments. At Kirkintilloch, for example, a nickel works used to be supplied regularly with nickel ore by canal boat ; but on the North British building a small spur from their lines into the works, the Caledonian handled no more of the traffic on their canal.

While, again, the Forth and Clyde Navigation, for a good part of its total length, passes through an agricultural district, it receives very little patronage from the local growers, apart from an occasional lot of potatoes from the farms or a load of manure to them. The farmers, it seems, find it more practicable to deal with convenient railway consignments rather than have to receive or forward in quantities of thirty, forty or fifty tons in a boat.

CHANGES IN PRODUCTION AND TRANSPORT.

Among the causes of traffic decline coming under this head there must be included the fact that a considerable number of coal pits in the vicinity of the Forth and Clyde Navigation which formerly provided a good deal of business for the waterway have become exhausted, and that, although others have been opened, these are so far distant from the canal that the use of it for the purposes of transport, and in preference to the railway facilities which can so easily be brought to them, does not come into consideration. Like exhaustion has also overtaken certain iron-stone pits in the north-east of Glasgow.

The large traffic in grain that once passed from the Baltic to Glasgow and the west of Scotland, via Grangemouth and the Forth and Clyde Navigation, ceased when Glasgow got her needs supplied from America.

The coasting vessels trading between the east of Scotland and the Highlands and Western Islands have increased so much in size in recent years, as compared with those in use when the Forth and Clyde Navigation was built, that they can no longer pass through the locks. A good deal of this traffic is now either carried round the north of Scotland or discharged at some intermediate port and taken inland by rail.

These various conditions and circumstances would seem to be amply sufficient in themselves to account for the steady decline of traffic on the Forth and Clyde Navigation in spite of every effort made for its maintenance and development.

PROPOSED ENLARGEMENT.

The further question has arisen from time to time as to whether the Forth and Clyde Navigation could not be widened and deepened so that it might accommodate vessels of a larger size, deal with more traffic, and render unnecessary the construction of an entirely new ship canal for sea-going vessels.

Mr. Millar dealt, also, with this subject in the evidence he gave before the Royal Commission, saying thereon :—

I can suggest no improvement which would be warranted by the traffic presently making use of the canal or by any prospective increase of traffic. Having regard to the dimensions of the canal and to what has been stated in regard to the decrease of traffic on the canals, I am of opinion that the canal is carrying as much traffic as it is likely ever to get. It may be an open question whether a wider and deeper canal, with larger locks, might not induce more traffic to use it. If so the traffic could only be through traffic. There is no place along the route of the canal, except at Grangemouth, Falkirk and Glasgow, where traffic arises, and it seems to me that the principal traffic which would use an enlarged canal would be sea-to-sea traffic, or traffic canal to sea, or vice versa. The cost of making a convenient dock in Glasgow to accommodate canal traffic and minimise cartage expenses as much as possible, so as to enable the canal to compete with the railways, would be enormous. . . . The cost of such an improvement as is suggested, including the cost of such a dock, would, in my opinion, be prohibitive. Money, of course, would widen the canal and lengthen the locks; but the great difficulty would be in the deepening of the existing canal, which I believe to be impossible.

Asked on what grounds he considered the deepening of the existing canal would be impossible, Mr. Millar replied :—

The existing canal crosses over several main lines of railway at different points, several main roads, and some of the streets in the city of Glasgow, and the space between the crown of the several arches and the bed of the canal is so restricted that no appreciable difference could be made in the depth of the canal. . . . Another obstacle to the deepening of the canal is the long viaduct which carries it across the River Kelvin, within the city of Glasgow. That viaduct, which is 350 ft. in length, would require to be taken down and rebuilt, which would prove a costly work.

These declarations—as true to-day as they were when they were made—should be borne in mind in view of the controversies to which the subject of a Mid-Scotland Ship Canal was to give rise, as will be shown in later Chapters.

WAR-TIME TRAFFIC.

Eight days after the declaration of war, a military guard was put over Grangemouth Docks, the eastern terminus of the Forth and Clyde Navigation. On November 13th, 1914, the port was taken possession of by the Government, and from that time no merchant ship was allowed to come within one mile of the Forth Bridge, either from the eastward or from the westward, without first obtaining permission so to do.

The effect of this regulation was to bring about a further substantial decline in the traffic carried on the Forth and Clyde Navigation, which, being railway-owned property, had already automatically passed under State control.

Early in April, 1918, a check was given to this decline by reason of the greater use of the waterway for Admiralty purposes.

Oil ships from overseas then began to come up the Clyde as far as Bowling, the western terminus of the canal, and there, as they lay in the outer harbour, the oil they had brought was pumped out of them into a fleet of boats which, previously in use on the canal for ordinary commercial purposes, had been converted into improvised oil-tank vessels. When full of oil, these boats were towed by steam lighters or tracked by horses along the full extent of the Forth and Clyde Navigation to Grangemouth Docks. There the oil they had brought was pumped out of them into the tanks of the British Petroleum Company, to be subsequently sent to the Fleet as required.

This procedure, however, was designed to serve only as a temporary measure, the Admiralty having already decided to lay an oil-pipe from Old Kilpatrick, on the east of Bowling, along the banks of the Forth and Clyde Navigation in order that the oil, pumped through the pipe for the entire distance of the canal, could be obtained at Grangemouth in greater bulk and in much less time. The work was begun on March 9th, 1918. It was carried out by the British and United States Governments in combination, the former being responsible for the excavation while the latter provided a Naval Pipe-line Unit for laying the pipe-line. Pumping stations were set up at either end of the line, with two others at intermediate points. It was not possible, however, to begin the pumping of the oil through the pipe until November 10th, 1918, or only one day before the signing of the Armistice, though operations were continued subsequent to that date, the total amount of oil passing through the pipe up to May 18th, 1922, being 398,779 tons. Of this quantity 366,604 tons were shipped from Grangemouth. Figures such as these bear ample testimony to the practical and continuous value of the pipe-line for naval purposes. The amount of oil carried on the canal by oil-tank vessels prior to the completion of the pipe-line was 137,514 tons.

What the traffic on the Forth and Clyde Navigation really amounted to under war-time conditions will be seen from the following table, which continues the one down to 1913 given on p. 132 :—

YEAR.					TONS.		REVENUE.
							£
1914	.	.	.	.	580,446	..	25,165
1915	.	.	.	.	281,243	..	5,806
1916	.	.	.	.	256,596	..	5,100
1917	.	.	.	.	240,192	..	5,008
1918	.	.	.	.	348,291	..	3,846
1919	.	.	.	.	236,578	..	5,738
1920	.	.	.	.	247,447	..	7,192
1921	.	.	.	.	184,410	..	12,032

It will be seen that although there was an increase in traffic of 108,099 tons in 1918 as compared with 1917, there was a decline of £1,162 in revenue, this being due to the fact that the oil carried on Government account would not be paid for direct but added to the railway company's working expenses, to be made good by the Government guarantee. The increased revenue in 1921 on a still lower tonnage was attributable to the canal tolls, dues and charges having been increased by 100 per cent. as from October 1st, 1920, by an Order of the Minister of Transport, dated September 14th, 1920.

PART III.—CANALS CONNECTED WITH THE FORTH
AND CLYDE NAVIGATION.

CHAPTER VII.

THE MONKLAND CANAL.

ALTHOUGH originally designed to serve purely local purposes, the Monkland Canal has a history which is not only of much interest in itself but helps no less than that of the Forth and Clyde Navigation to throw light on the causes and conditions leading to that steady decline in traffic which has long been so marked a feature of British canal transport in general.

The reasons for the construction of the Monkland Navigation—as it was officially designated—are to be found in the conditions in which the city of Glasgow was at one time placed in regard to coal supply.

There was an abundance of coal in the neighbouring coalfields of Lanarkshire, but this was practically unavailable for Glasgow owing to the lack of adequate transport facilities, and the monopoly gained by coal-owners in localities from which supplies could be got enabled them to exploit the manufacturers and citizens of Glasgow very much to their own advantage, and very much to the detriment of the exploited. These conditions became especially acute in the year 1769, and the Magistrates and Council, who then formed the governing authority of the city, had the idea that, if only they could bring about the construction of a canal from the pits in the Airdrie and Coatbridge or Monkland districts in Lanarkshire to the neighbourhood of Glasgow, they would secure alternative supplies which would break down the monopoly and secure coal for Glasgow at a more reasonable price.

They accordingly approached James Watt and invited him to make a survey and draw up an estimate for a canal to serve the desired purpose. Watt thus referred to the matter in a letter he wrote to Dr. Small,¹ under date December 12th, 1769 :—

I somehow or other got into the good graces of our present magistracy, who have employed me in engineering for them (as Mr. Smeaton terms it) ; among other things I have projected a canal to bring coals to the town, for though coal is everywhere hereabouts in plenty, and the very town stands upon it, yet measures have been taken by industrious people to monopolise it and raise its price 50 per cent. within these ten years. Now this canal is nine miles long, goes to a country full of level free coals of good quality, in the hands of many proprietors, who sell them at present at sixpence per cart of 7 cwt. at the pit. There is a valley from Glasgow to the place, but it has a rise of 266 ft. perpendicular above our river ; I therefore

¹ See p. 5.

set that aside, and have found among the hills a passage, whereby a canal may come within a mile of the town without locks, from whence the coals can be brought on a waggon-way. This canal will cost £10,000—is proposed 16 ft. wide at bottom, the boats 9 ft. wide and 50 ft. long, to draw $2\frac{1}{2}$ ft. water.

As the result of the survey and estimate made by Watt, the Magistrates and Council, in combination with "proprietors of land and coal" alongside the line of route of the proposed canal, presented a petition to the House of Commons in February, 1770, seeking leave to bring in a Bill for the granting to them of the powers they desired. In this petition they set forth (*inter alia*):—

That the price of coal is daily increasing in Glasgow to the great detriment of its trade and manufactures, and that there are almost inexhaustible funds of coal in the parishes of Old and New Monklands which can be wrought at a very moderate expense, but on account of the distance cannot easily be brought to Glasgow by land carriage; and that from surveys which have been made it appears practicable to make a navigable cut or canal, passing from these collieries to Glasgow passing mostly through the lands of the petitioners, beginning at or near a place called The Sheep Foord in the parish of Old Monkland and passing by or near the House of Drumpellier¹ and may terminate at the City of Glasgow, or Broomelaw Quay, or near it, and communicate by a road or waggon way from the west end of the said canal to the said city or quay; and that the petitioners conceive that such a cut or canal, by reducing the price of carriage will enable them to supply the city of Glasgow with pit coal at a moderate rate; for which purpose a public voluntary subscription has been opened and several thousand pounds have been subscribed.

Hence they prayed for leave to bring in a Bill for the construction alike of a canal from New Monklands to the outskirts of Glasgow and of a "road or waggon way" therefrom to communicate with the city and the Clyde. By this latter proposal, apparently, it was thought to avoid the necessity of overcoming, by means of locks, a considerable difference in elevation at Blackhill, thus realizing Watt's suggestion of a canal to be brought "within a mile of the town without locks."

An Act, as desired, was granted by Parliament in 1770, and the Company of Proprietors of the Monkland Navigation were authorized to raise £10,000 capital in £100 shares, and a further £5,000 in case of need. Watt was appointed engineer at a salary of £200 per annum, and he held that position from June, 1770, to December, 1772.

Construction was begun as soon as the Act was obtained; but the undertaking was found a much more costly one than had been anticipated. The original subscription was exhausted by 1780, and, owing to the financial depression caused by the American War, the original subscribers—including Glasgow merchants, the City Corporation, the Trades Houses, and the Incorporated Society of Maltmen, Wrights, Bakers and Fleshers—were disinclined to provide any further funds.

When opened for traffic the canal was still in an unfinished state. For some years it produced little or no revenue. Various creditors began to press for payment; stockholders who had lost confidence in the undertaking declined to make further advances either for finishing the

¹ The modern method of spelling "Drumpellier" is "Drumpeller."

work or for paying off the accumulation of debts, and in 1782 it was decided to sell the entire capital stock of the company by auction. Most of it was acquired by Andrew Stirling, of Drumpeller, and William Stirling and Sons, of Glasgow, who subsequently became proprietors of the whole of the shares.

JUNCTION WITH THE FORTH AND CLYDE CANAL.

The Stirlings proceeded to complete the work, but the results, in the first instance, were very unsatisfactory.

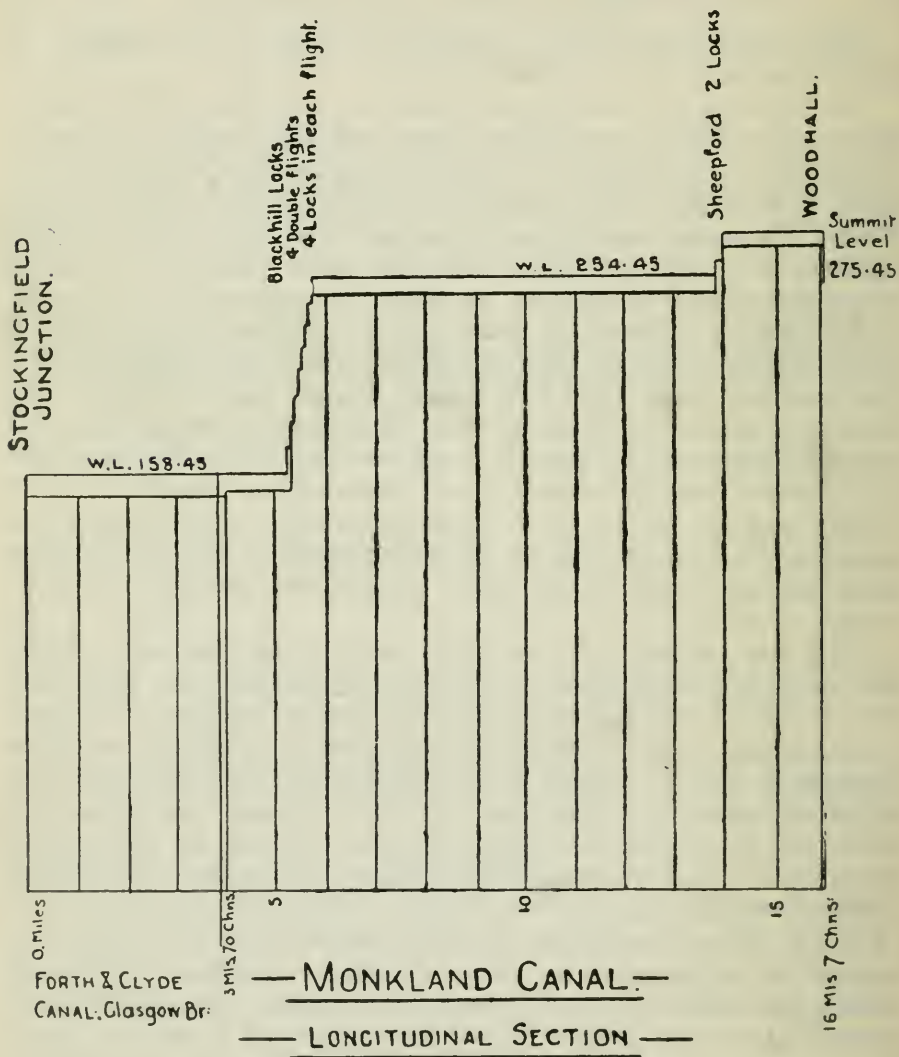
As originally constructed, the canal extended from the Townhead Basin, at St. Rollox, near Glasgow, for a mile and a half to the foot of a steep ascent, at Blackhill. This short length, which formed the first reach, took the place of the wagon-way proposed at the outset by James Watt. The second reach began at the top of the ascent and extended eastward to Sheepford, a distance of eight miles, where it was stopped by another ascent, no locks at all being then provided on the canal. At Blackhill the difference in elevation of the two reaches was overcome by an inclined plane for railway wagons. The coal brought there by the boats was transhipped into railway wagons, and these were then lowered to the level of the first reach, where the coal was again loaded into canal boats and so taken on to the terminal basin. The procedure thus followed naturally involved much labour and no little deterioration of the coal as the result of so much handling. About 1788 the provision of a set of locks at Blackhill allowed of the boats passing from the one reach to the other without any need for transhipment.

This was certainly a better plan; but the fact was soon realized that an entirely independent navigation of the limited extent authorized by the Act of 1770 had no prospect of financial success. It became apparent, also, to the Company of Proprietors of the Forth and Clyde Navigation, that the outlook for themselves would be greatly improved if that waterway were linked up with the Monkland. So it was that under the Act obtained in 1790 by the two interests, the Company of Proprietors of the Forth and Clyde Navigation were empowered to extend their collateral cut $1\frac{1}{2}$ miles from Hamilton Hill to the western terminus of the Monkland Navigation, to make a harbour and basin there, and to provide warehouses, etc., for merchants as a means of facilitating their traffic, while the proprietors of the Monkland were authorized to increase the original depth thereof from 3 ft. to $4\frac{1}{2}$ ft., and to extend the canal two miles, from Sheepford to Woodhall, on the river Calder, so that a better supply of water should be available for the two undertakings when the physical connection between them had been established. This meant that the Monkland would be continued to a point thirteen miles east of Glasgow.

In regard to these construction details, it might also be mentioned that the Monkland is spanned by thirty-four fixed over-bridges having a minimum height of 7 ft. 2 in. above water level. All are stone arch

bridges which, unlike the bridges on the Forth and Clyde Navigation, do not admit of the passage of vessels with masts.

Subsequent to the opening of the Monkland throughout in 1792, the revenue was for a number of years absorbed by the obligations incurred on account of the extensions and the other improvements which had been carried out.



By this time, however, the outlook had become much more promising. The junction made between the Monkland and the Forth and Clyde had a powerful influence on the fortunes of both undertakings. It was now possible to send coal by water from the Monkland district to Glasgow, Greenock and Ireland on the west, and to various destinations, inland or along the coast, on the east. At one time the prospects of the canal were so unfavourable that the value of the £100 shares fell to £5 or £7 each,

and the company seriously contemplated the idea of filling up the waterway, so that the land could be used for some more remunerative purpose. If they refrained from adopting this course, it was mainly because they had not got sufficient funds left to pay for the cost of the labour! With, however, the general improvement in the position now brought about, and the development of the mineral and industrial resources of the district served, the undertaking entered on such a period of prosperity that shares which had once been as low as £5 were eventually worth about £3,200.

In respect to the advantages which Glasgow derived from the canal, the writer of a pamphlet concerning the proposed Edinburgh and Glasgow Canal¹ said that public attention had, of late years, been the more strongly attracted thereto by reason of the striking advantages which Glasgow had derived from the Forth and Clyde Navigation and the Monkland Canal. He continued:—

By establishing the cheap communication between itself and the more remote districts of coal in the parish of Monkland and other places, it [Glasgow] has obtained a more plentiful, and, at the same time, a cheaper, supply of fuel than perhaps any other town in Europe enjoys. . . . Even the coal masters in the vicinity of Glasgow whose profits seemed at first endangered by these measures have been ultimately enriched by them.

RAILWAY COMPETITION STIMULATES CANAL ENTERPRISE.

About 1825 a considerable expansion of traffic set in on the Monkland Canal owing to the establishment of a number of iron works or other industrial establishments alongside or in the immediate vicinity of the waterway in order to take advantage of the transport facilities it afforded; and when railways began to appear, some degree of alarm was aroused in the minds of the canal company at the prospect of their losing a good proportion, at least, of their business. Instead, however, of following the example of many of the English canal companies, under like conditions, in regarding the situation as hopeless, the proprietors of the Monkland Canal sought to meet the situation by the adoption of various expedients.

Among other things they reduced their canal dues to one-third of what they had previously charged (a fact which showed once more how, in the days before railway competition was established, the canal companies enriched themselves at the cost of the traders whom they held at their mercy); they provided additional reservoirs; they constructed extensive loading basins for the reception of traffic from mineral railways which hitherto they had regarded merely as feeders to the canal; they either themselves brought about or helped in the formation of a Drumpeller Railway Company which built a short railway line between the canal and some mines in the parishes of Monkland and Bothwell, this line being

¹“ Answer to a Pamphlet entitled, ‘ Observations on the Report of Mr. Hugh Baird, Civil Engineer, relative to the Proposed Union Canal.’” By James Grahame, Esq., Advocate. Edinburgh, 1814.

afterwards transferred to the Monkland Canal Company under powers provided for in the Act authorizing its construction, and they built at Blackhill in 1841 new locks which were so complete and so costly that they were declared to excel "all works of their class in Great Britain." The locks comprised four double flights, with four locks in each flight; and each lock was 70 ft. long, 13 ft. 6 in. wide and 6 ft. deep, giving a total rise of 96 ft. Three basins were also provided. The amount expended on these double locks was about £30,000. Two other locks, at Sheepford, allowed of a rise of 10 ft. 6 in. each, the total difference thus overcome between the summit level (275 ft.) and the water level at Port Dundas (158 ft.) being 117 ft.

AN INCLINED PLANE FOR BOATS PROPOSED.

In 1837 the two uppermost of the original locks at Blackhill were in so defective a condition that it became necessary either to rebuild them or to provide new ones. On the advice of Mr. James Leslie, the engineer of the canal, the Company of Proprietors resolved to construct two double flights of locks by the side of the old ones and as substitutes for them. By the time, however, that these new locks had been completed, the traffic had increased to such a degree that the need was found to have arisen either for a second set of locks or for the devising of some other means of passing a larger number of boats than could be accommodated by the one set of locks then alone available. Thereupon Mr. Andrew Thompson, civil engineer of Glasgow, who had superintended the construction of the new locks, suggested, in January, 1839, the adoption, supplementary thereto, of an inclined plane for the purpose of raising empty boats in a cassion of water from the lower to the higher level.

It was, in fact, a question of making additional provision for dealing with empty rather than with loaded boats. About seven-eighths of the traffic on the canal consisted of coal and iron passing downwards towards Glasgow, the one-eighth carried in the opposite direction was mainly ironstone, limestone and manure. Consequently, nearly all the boats which descended the canal were loaded, and nearly all of those that returned were empty.

The idea of an inclined plane of the type in question for use on a line of canal was not then entirely new, but Mr. Thompson recommended the resort to one as specially applicable to conditions on the Monkwell. His plans were referred by the Committee of Management to Mr. Leslie, who advised that, subject to certain modifications, they should be adopted. Sir John Macneill, who was also consulted, took a similar view. The Committee of Management decided, however, that, instead of constructing an inclined plane, they would rebuild the two upper locks which were no longer serviceable and, also, build two new lower ones. This was done in 1841, and thus it was that the four double flights of locks spoken of above were attained.

TRANSFER TO THE FORTH AND CLYDE NAVIGATION COY.

An Act for the transfer of the Monkland Canal and its various properties to the Company of Proprietors of the Forth and Clyde Navigation was obtained in 1846, the adoption of this course being the logical outcome of the physical junction which had led to the two navigations becoming practically one system.

AN INCLINED PLANE CONSTRUCTED.

Three years later, serious difficulties arose on the Monkland in regard to water supply. The new reservoirs constructed had a storage capacity of more than 300,000,000 cubic ft.; but this was so far from being sufficient to provide for the expenditure of water required in working the locks that, in combination with an especially dry season, the canal had to be closed altogether for a period of six weeks.

With a view to avoid a repetition of this experience, various proposals were considered, and eventually the scheme of an inclined plane, as modified by Mr. Leslie in 1839 from the original proposals made by Mr. Thompson was adopted. The work of constructing the inclined plane, immediately alongside the locks, was completed by July, 1850, at a cost of over £13,000. The height to be overcome at Blackhill was 96 ft., the length of the incline was 1,040 ft., and the gradient 1 in 10.¹

The incline was used solely for the raising of empty boats from the low to the high level, the boats being taken up in a tank and cradle-hauled by a steam engine at the top of the incline. It was operated, however, during only six or seven months of the year, when the water supply was likely to be short. In the season of 1851 the number of boats which passed over it was 5,452, and the aggregate saving of water effected thereby amounted to 60,000,000 cubic ft., equal to about two months' supply for the then existing traffic. In the five years ending 1856 the average number of boats dealt with per annum by the incline was 7,500. The actual saving per boat was estimated at five-sixths in respect to water and nine-tenths in regard to time. In addition to the saving in these directions there was, also, economy in wear and tear of boats and gates and in labour of men and horses, as compared with the use of the lifts.

For a period of thirty-seven years, or thereabouts, this inclined plane was kept in operation. It continued to be of great practical service; but, with the falling off in traffic which the canal had begun to experience the incline became too costly to work, the water supply from the reservoirs was now found equal to all demands, while the time came when there was

¹ "Description of an Inclined Plane for conveying boats from one level to another on the Monkland Canal, at Blackhill, near Glasgow, constructed in 1850, from designs by James Leslie, Civil Engineer, Edinburgh." Three Plates. *Transactions of the Royal Scottish Society of Arts*. Vol. IV. Edinburgh, 1856. [A paper read before the Society by Mr. Leslie, April 28th, 1851.] "Description of an Inclined Plane for conveying boats over a summit to and from different levels of a canal." By Mr. James Leslie. *Proceedings of the Institution of Civil Engineers*, Vol. XIII. London, 1854.

no longer any necessity to pass empty boats otherwise than through the locks. The use of the inclined plane was thus discontinued about the year 1887. The structure which had served so useful a purpose thereupon fell into rapid decay. Finally, what remained of it was disposed of as scrap.

PASSENGER-BOAT SERVICES.

Prior to the introduction of competing railways, the Monkland Navigation Company ran a passenger-boat service regularly between Sheepford, Coatbridge, and Glasgow, the journey taking two or three hours. The service was continued until the company disposed of the canal to the Forth and Clyde Navigation Company. Thereupon the passenger boats then in use were sold to private parties who continued to run them a short time longer.

STEAM LIGHTERS.

When, again, steam lighters were introduced on the Forth and Clyde Navigation, in 1856, similar vessels were also put on the Monkland Navigation.

REASONS FOR TRAFFIC DECLINE.

Under the amalgamation effected in 1867, the Monkland Canal was among the properties owned by the Forth and Clyde Navigation Company which were then transferred to the Caledonian Railway Company; but the decadence of the canal, on which the principal traffics were coal, fire-clay goods and pig-iron, had then set in, and it has continued ever since.

In the evidence he gave to the Royal Commission on Canals and Waterways in 1907, Mr. Millar, as General Manager of the Caledonian Railway Company, dealt with the reasons for the traffic decline on the Monkland Canal, just as he also dealt with that on the Forth and Clyde Navigation; and the account he gave in the one instance was practically a repetition of that which he had given in the other.

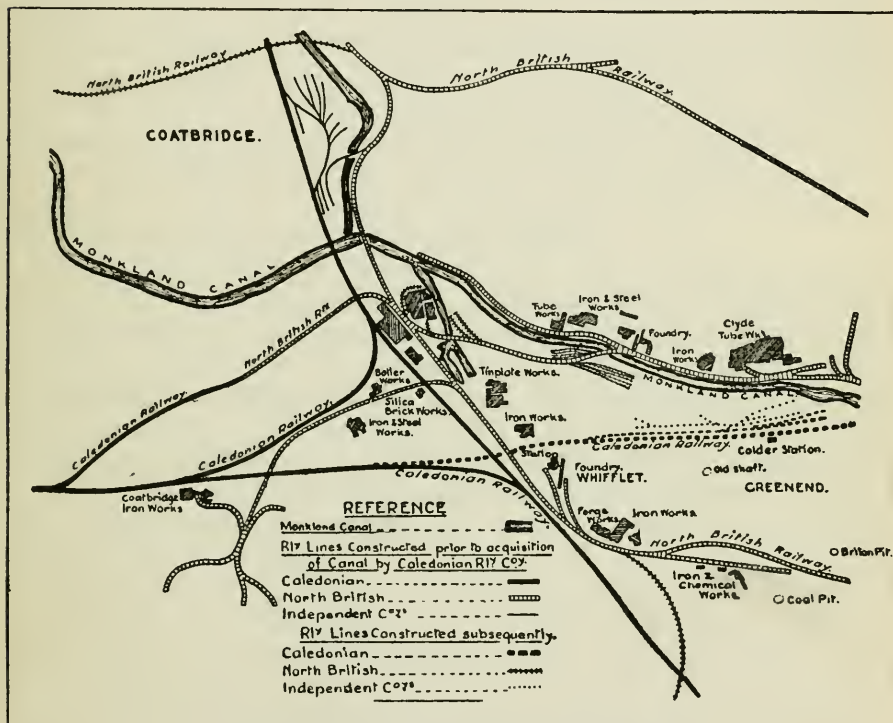
The Monkland, as we have seen, was originally constructed for the transport of coal from what were then known as "the great Lanarkshire coal-fields"; but in course of time many of the collieries in the neighbourhood became exhausted, and no longer supplied the canal with any traffic at all.¹ Other collieries were started, but these were mostly some distance away, and when it became a question of first putting the coal into railway trucks and then sending it down to the canal to be transhipped into barges or steam lighters, with a further possible transshipment to follow, it was found cheaper, more convenient, and of greater advantage to forward all the way to destination by rail.

Mr. Millar further told the Commission that nearly all the malleable iron produced in Scotland came from works in the Coatbridge and Airdrie

¹ The Drumpeller Railway was closed in 1896 owing to the fact that the pits from which it had previously conveyed coal to the Monkland Canal had been worked out.

districts which were alongside the Monkland Canal—and should, theoretically, have supplied that canal with an abundance of traffic. But these districts are well served by the North British and Caledonian Railway Companies, which have sidings into every one of the said works, and the whole of the traffic goes by rail. The Caledonian, Mr. Millar said, would be very pleased to carry the traffic; but they did not get a single pound of it for their canal. The railways were more convenient for the manufactures, for the district and for the shipping at Glasgow, and it was the railways that got the business.

These conditions were accentuated by the fact that, after the Cale-



THE MONKLAND CANAL AT COATBRIDGE.

donian Company acquired the Monkland Canal, a number of new railways were opened, serving works and collieries throughout the district and tapping the canal traffic along its line of route, while an extension of the North British Railway, between Glasgow and Coatbridge, opened in 1870, diverted from the canal practically all that it had formerly carried between those two points.

It will thus be seen that in the case of the Monkland Canal, no less than in that of the Forth and Clyde Navigation, the railway company to whom it belongs have had a direct interest in getting as much waterway traffic as they could, and so prevent its transfer to the railway lines of their competitors. Yet, in spite of this fact, and for the reasons here

stated, traffic and revenue on the Monkland have suffered the steady decline to which the following figures bear witness:—

YEAR.	TONNAGE.	REVENUE.	YEAR.	TONNAGE.	REVENUE.
		£			£
1863 . . .	1,529,918	.. 37,987	1915 . . .	61,562	.. 1,582
1873 . . .	954,470	.. 21,263	1916 . . .	62,951	.. 1,616
1883 . . .	586,995	.. 13,767	1917 . . .	59,303	.. 1,531
1893 . . .	155,036	.. 3,394	1918 . . .	55,224	.. 1,393
1903 . . .	108,278	.. 2,341	1919 . . .	44,708	.. 1,072
1913 . . .	77,489	.. 1,915	1920 . . .	52,023	.. 1,422
1914 . . .	66,710	.. 1,649	1921 . . .	30,128	.. 1,284

CHAPTER VIII.

EDINBURGH AND GLASGOW UNION CANAL.

WHEN the citizens of Edinburgh saw that Glasgow was gaining so much advantage from the Forth and Clyde Canal Navigation, and, also, was securing a cheaper and more abundant supply of coal by means of the Monkland Navigation, they became desirous of obtaining similar benefits—the more so since, as was pointed out in the article on “Navigation Inland” published in the “Edinburgh Encyclopædia” (1830), the fact that the eastern terminus of the Forth and Clyde Navigation was at Grangemouth left the intermediate intercourse between the cities of Edinburgh and Glasgow—as well as that of a great extent of the intervening and populous country—to land carriage.

The desired benefits for Edinburgh could, it was thought, best be assured by means of a waterway connection with Glasgow which would not only provide for commercial intercourse between the two cities but place Edinburgh in a better position to benefit from the “large and inexhaustible” coalfields of Lanarkshire, then practically inaccessible to the city owing to the lack of just such transport facilities as a canal serving the special interests of Edinburgh would provide. It was, however, considered essential that this canal should be continued to Edinburgh’s port in order that direct communication might be established between Leith and Glasgow.

Strengthened by the support of colliery proprietors and landowners who had their own interests to serve in the matter, the various considerations involved were especially impressed on the people of Edinburgh by the scarcity of coal there during the severe winters of 1793 and 1794; and in January of the former year a meeting convened to consider the question of a canal appointed a committee which was authorized to employ “engineers of the first eminence” to report on a line of route likely to serve the two-fold purposes in view. This committee approached Robert Whitworth, junr., who, in conjunction with another engineer, John Ainstie, made surveys and reported on four different routes; though the influence of the coal-owners and landed gentry was then so great that the main purpose aimed at in each instance was that of developing the coalfields and facilitating the dispatch of coal to Edinburgh, with little or no consideration for the promotion of trade and commerce in general or for the provision of another line of cross-country communication, which object was also being kept in mind, though there was then no idea of making provision for passenger services by canal.

Owing to the conflicting nature of the interests concerned, no decision could be arrived at as to which of the four schemes should be adopted, and any further action was suspended until 1795, when the increasing revenue of the Forth and Clyde Canal and the further evidence afforded as to the good service which that waterway was rendering led to a revival of the Edinburgh project.

The Committee of Subscribers to the scheme now called in John Rennie to advise them; and, under date September 14th, 1797, Rennie presented a "Report concerning the different lines surveyed by Messrs. John Ainstie and Robert Whitworth, junr., for a canal proposed to be made between the cities of Edinburgh and Glasgow and intended to communicate with the Firth of Forth at Leith and the River Clyde at Broomie Law; with an account of a running level taken for a new line by Linlithgow and Falkirk." In this report Rennie referred to the considerable elevations above high water at Leith which the routes proposed to be followed in the four schemes in question would have to overcome, these being 873 ft. in 20½ miles; 785 ft. in 24 miles; 774 ft. in 25 miles, and 629 ft. in 29½ miles respectively. The one that attained the greatest elevation of all he considered impracticable on account of inadequate water supply and for other reasons. In regard to the three others, he suggested certain improvements and the making of more complete surveys which might have the effect of rendering them less open to the objections they offered; but he nevertheless thought that preference should be given to an entirely different route. This one, starting from the Monkland Canal at Drumpeller, would reach Edinburgh by a more northerly course, longer in distance, though at a lower level, and requiring much less lockage than the others. It offered the disadvantage of being further away from the coalfields than the Whitworth routes; but the coal could, he said, be brought into it "by proper side branches and rail roads"—the last-mentioned being, at this time, regarded as adjuncts or feeders to canals rather than as an independent and superior means of transport.

Rennie was authorized to make a detailed survey of his alternative route, and this he did, presenting a report thereon in October, 1798. The canal he recommended was to have a total length of sixty-four miles from the harbour of Leith to the Broomielaw at Glasgow, and was either to join the Monkland Navigation, at Drumpeller, or continue on the same level as that waterway to within two miles of Glasgow, whence it would descend by locks to the Clyde. One of the advantages he suggested in favour of this alternative route was that, by means of it, there would be the prospect of securing a greater volume of general merchandise, in addition to coal, together with the patronage of a large number of passengers, to whom he looked for a considerable augmentation of the revenue.

Rennie's idea of a canal having an outlet in the Monkland Navigation and affording access to Glasgow and the Clyde by that route, in preference to linking up with the Forth and Clyde Navigation, was favoured by

those who saw in it a means of checking further expansion in a traffic monopoly of which, they considered, the latter navigation was taking undue advantage in the charges it imposed.¹ On the other hand, Rennie's own proposal failed to offer to the colliery and landowning interests the same advantages to themselves as were foreshadowed by the Whitworth schemes—now practically abandoned owing to lack of public support—and the consequent withdrawal of these interests, in turn, led to the whole matter being left in abeyance for a period of about fifteen years.

THE BATTLE OF THE ROUTES.

No further definite action was taken, in fact, until 1813, when, at the instigation of certain of the Forth and Clyde Canal proprietors, Mr. Hugh Baird, the resident engineer of that waterway, brought forward a scheme for the construction of a Union Canal from Lothian Road, Edinburgh, to a junction with the Forth and Clyde Navigation at Lock No. 16, near Falkirk, such junction being effected by a flight of locks. Baird assured the citizens of Edinburgh that by means of this canal they would obtain coal at two-thirds the price they were then paying. He predicted, also, important improvements in agriculture, commerce and manufactures, together with a substantial revenue for the canal proprietors from passenger traffic.

On this question of passenger traffic, one of Baird's supporters² wrote that, when the proposed Edinburgh branch canal was constructed, a certain number of boats would make the journey by night and would provide "commodious beds" in which the passengers could be conveyed "without fatigue or loss of time, and at the lowest possible expense." No fewer, he said, than 40,000 persons were then travelling annually in the stage coaches between Glasgow and Edinburgh. The voyage by canal between these two cities would take eleven hours by day and twelve hours by night; though these times might be reduced by the employment of lighter and improved boats.³

The fundamental difference between the schemes which had been proposed by Rennie and Baird respectively lay in the fact, not only that the former began at Leith while the latter began at Edinburgh, but that Rennie, inspired thereto by the authorities of Edinburgh, had projected an entirely new waterway which would more or less parallel the Forth and Clyde Canal and be a rival to it, whereas Baird's scheme proposed to utilize the Forth and Clyde from Falkirk to Glasgow, thus effecting a considerable saving in the cost of construction. In some "Observations by the Committee of Subscribers of the Edinburgh and Glasgow Union Canal submitted to the consideration of the Right Honourable

¹ See p. 118.

² "Answer to a Pamphlet entitled, 'Observations on the Report of Mr. Hugh Baird, Civil Engineer, relative to the Proposed Union Canal.'" By James Grahame, Esq., Advocate. Edinburgh, 1814.

³ The rail journey between Glasgow and Edinburgh is now done by express trains in a little over one hour.

the Lord Provost and City Council of Edinburgh," early in 1814, it was said:—

Should the Right Honourable the Lord Provost, Magistrates and Council of Edinburgh succeed in having it decided by Parliament that no inland navigation shall ever be established betwixt Edinburgh and Glasgow except on the principle of making a rival canal to the Forth and Clyde Navigation, then the public may rest assured that no adventurers will ever be found to advance the enormous sum of upwards of half a million, on a speculation so palpably imprudent; and the Inhabitants of Edinburgh must submit, in time coming, to pay fifty per cent. higher for their Coals than the Glasgow prices.

The cost of carrying out Baird's scheme was estimated at £235,000, as against £470,000 for the route proposed by Rennie, and the new proposals were so well received that the capital subscribed towards the said £235,000 speedily attained the sum of £200,000. The scheme, nevertheless, met with active opposition, partly from the coal-owning interests, by reason of the threat it involved to their monopoly of the Edinburgh trade, and partly because the canal was not to go beyond Edinburgh, whose port of Leith would thus be excluded from that direct water connection with Glasgow which the earlier schemes offered in deference to what had been regarded as an indispensable feature of the project.¹ This latter view was strongly held by the Lord Provost and Council of Edinburgh, the former declaring that no proposal whatever for any canal to Edinburgh which did not "lock down" to Leith would be listened to by them.

The Committee of Subscribers to the Union Canal argued that it was a railway, and not a canal, which should connect Edinburgh and Leith; but they undertook, in January, 1814, that if it could be shown, by the report of any skilled engineer, mutually appointed, that the expense of carrying the canal down to Leith could be kept within such limits as would lead to the extension being "consistent with prudence," they would agree that the said extension should be made at a period when the additional capital could be raised and an Act of Parliament obtained.

These views and assurances failed, at the time, to satisfy the objectors, and the Committee of Subscribers had with the Lord Provost and Magistrates of Edinburgh what they described as "a long and unpleasant correspondence" on the subject.² The Committee had intended to promote a Bill in the Session of 1813 with a view to securing Parliamentary powers for the carrying out of their project; but they agreed to take no further action for another year in order to give "the Governors of the Good Town" full and ample time to make such investigations on their own account as they might think fit. In July, 1814, the chairman of the

¹ In the Mitchell Library, Glasgow, there is a volume of "Forth and Clyde Pamphlets" relating (*inter alia*) to various aspects of the Union Canal controversy, among them being one entitled, "Papers written in Opposition to the Union Canal." This particular pamphlet, published at Leith in 1817, consists mainly of articles and letters reproduced from the periodical Press, and extends to 118 pages 8vo.

² "Correspondence between the Committee of Subscribers to the proposed Union Canal between Edinburgh and Glasgow and the Right Hon. the Lord Provost and Magistrates relative to that undertaking." 15 pp. Edinburgh, 1814.

Committee, Mr. Alexander Livingston, having in view the need for preparing Parliamentary notices for the next Session, wrote to the Lord Provost and Magistrates asking if they had yet made up their minds. He assured them that the line now proposed was the "easiest, least expensive and most likely to be profitable" of any yet suggested; he declared that the only objection to it was that it did not go to Leith, and he added that although, during the previous twenty years, other schemes which did propose to go to Leith had been advocated, all of them had since been abandoned.

To this the Lord Provost replied that the time was unfavourable for "taking the public sentiment" on the question; that the authorities were compelled to resent any line of canal which it might be attempted to force upon them; that they had obtained a further report from Mr. Rennie, together with a mineral report, and that the inquiries resulting therefrom were not yet in such a state of forwardness as would enable them to arrive at a final judgment.

The real fact was that, in the interval which had elapsed, another new departure had been taken in the matter.

At one of the numerous public meetings held to discuss the questions at issue, it was stated that Robert Stevenson had suggested the adoption of a still lower line of route for the proposed canal, and one that would permit of vessels proceeding on one level between, at least, Edinburgh and Port Dundas (Glasgow), with a provision of locks for continuing the journey between Edinburgh and Leith at the one extremity and between Port Dundas and the Broomielaw at the other. Thereupon, in April, 1814, the Lord Provost, Magistrates and Council of the city of Edinburgh commissioned Stevenson to make a "general survey" and to report to them on the subject. This he did, and he presented a "Report Relative to a Line of Canal upon one Level between the Cities of Edinburgh and Glasgow."

Stevenson's scheme—the seventh of the series—was for a canal which, rising by means of fourteen locks from Leith to Edinburgh, would thence follow a line 80 ft. lower than that of the proposed Union Canal, going from the centre of Edinburgh to Lock No. 20 (about two miles west of Kilsyth), on the summit level of the Forth and Clyde Navigation and so on to Port Dundas, without the intervention of a single lock between those points. To secure this result, however, it would be necessary to take the canal through Winchburgh Hill by means of a tunnel nearly three miles in length. Connection between Port Dundas and the Clyde at the Broomielaw was to be established by means of a flight of fourteen locks. In this way the canal would have passed—as in the case of the earlier and now abandoned schemes—through "the village of Cowcaddens," divided the city of Glasgow into halves, and given the canal access to the Clyde at the Broomielaw end of Robertson Street, then situate in open country.

The main consideration in favour of Stevenson's scheme as against Rennie's was that it avoided the paralleling of the Forth and Clyde

Canal between Falkirk and Glasgow, saving expense by utilizing that waterway from Lock 20 to Port Dundas; but the proposal to include in the canal a tunnel three miles in length was fatal to the project, which, in spite of all the efforts made by the local authorities in its favour, received no greater degree of public support than had already been extended to Rennie's.

In this battle of the routes it was Baird's plan—with which Telford was now associated—that won the final victory. The promoters got their Act in June, 1817, after having, apparently, overcome the objections of the authorities of Edinburgh, since the name of the Lord Provost was included on the list of subscribers, while the Magistrates and Town Council of the city were, under the Act, to receive a duty of one penny per ton upon all goods, etc., except manure, loaded, shipped or landed on the basins, quays or wharves situate within one mile of the eastern terminus of the canal in Edinburgh.

CONSTRUCTION AND OPENING.

Construction was begun in 1818, and in the issue of the *Scotsman* for Saturday, March 7th, in that year it was reported:—

We have great pleasure in announcing that on Tuesday, after the adjournment of the general meeting of the Union Canal Company, the Committee of Management, with many of the proprietors, proceeded to the west end of Fountainbridge, the spot fixed for the basin, where they were met by the engineer and contractor, and, after an appropriate and impressive prayer by the Rev. David Dickson, junior, Mr. Downie, of Appin, president of the Company, dug the first spadeful in this extensive work.

The opening of the canal was thus briefly announced in the *Scotsman* of Saturday, May 11th, 1822:—

The Union Canal is now open from Port Hopetoun to its junction with the Forth and Clyde Canal. On Saturday the first boat since the junction arrived at Port Hopetoun with flagstones from Denny, four miles the other side of Falkirk.

In those early days Port Hopetoun, the eastern starting-point of the canal, was described as being in the Lothian Road, "near Edinburgh," and in 1836 it was spoken of in "The Pocket Guide to the Picturesque Scenery of Scotland" as "in the immediate vicinity of the meadows on the one hand and Princes Street on the other."

From Port Hopetoun to Lock 16, at Falkirk, the distance is about twenty-five miles; but the actual length of the canal is thirty-one miles and a half, the difference being accounted for by the windings resorted to with the object of keeping the number of locks as low as possible. Thanks to the adoption of this policy, the canal runs on one and the same level for a distance of thirty-one miles from Port Hopetoun, and then, in the last half-mile, falls 110 ft. in one flight of eleven locks to the level of the Forth and Clyde at Falkirk. The canal is 40 ft. wide at the top of the banks, 37 ft. wide at the water surface, 20 ft. wide at the bottom, and 5 ft. deep throughout. The locks are 69 ft. in length and 12 ft. 6 in. in width.

It will be seen that, although designed as practically a branch of the Forth and Clyde Navigation, the Union Canal has smaller proportions, with the result that, although boats from the latter may pass on to the former, those from the former cannot necessarily pass on to the latter, the maximum widths and draughts for boats using each waterway being as follows :—

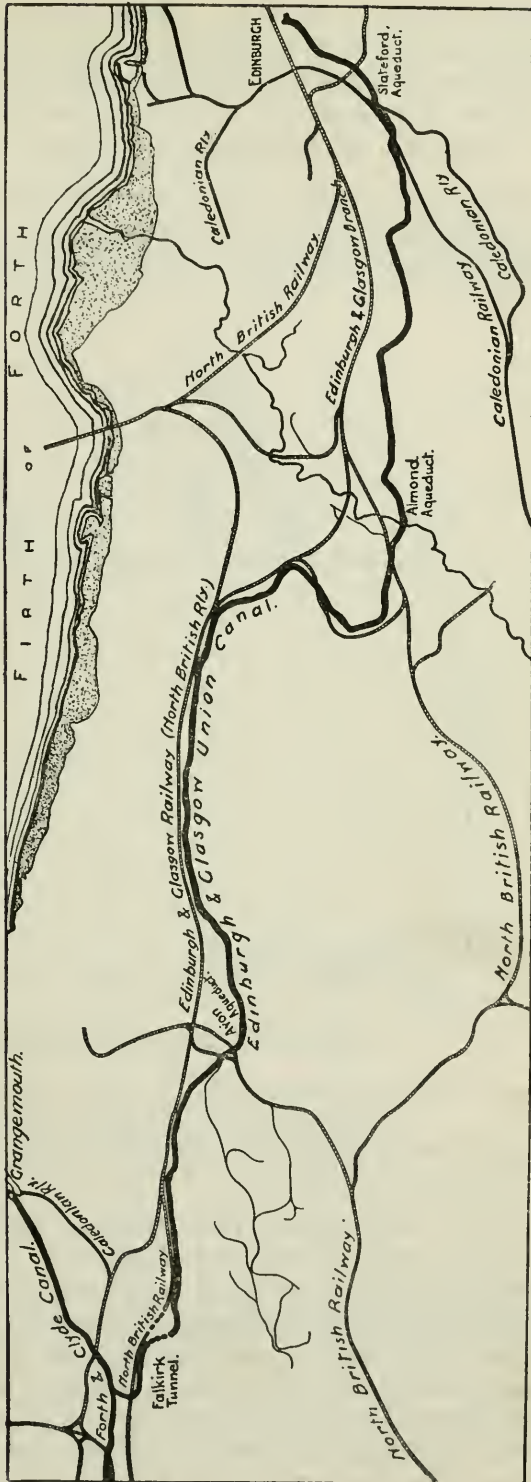
Forth and Clyde Navigation :

WIDTH.	DRAUGHT.
19 ft. 8 in.	8 ft. 9 in.

Union Canal :

WIDTH.	DRAUGHT.
11 ft. 3 in.	4 ft.

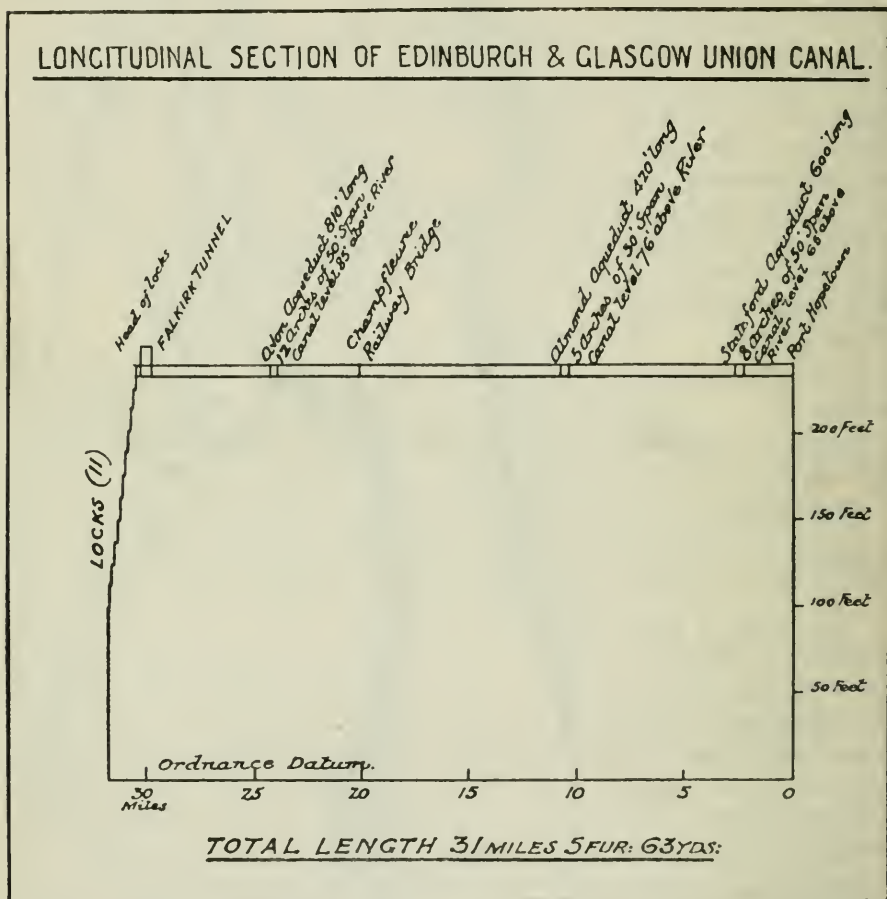
The canal is taken across the Water of Leith at Slateford by an aqueduct of five arches at a height of 65 ft. above the stream, and 600 ft. long. It is carried over the River Almond by an aqueduct of two arches, and it further passes over the River Avon at an elevation of 85 ft. above the stream by means of an aqueduct having twelve arches. There are, also, nine aqueducts over roads, while the canal is crossed by sixty-six road bridges and ten railway bridges. Half a mile south of



THE EDINBURGH AND GLASGOW UNION CANAL.

Falkirk it passes through a tunnel about 700 yards in length, cut through solid rock, and elsewhere there are deep cuttings and substantial embankments, together with much masonry work.

At the Edinburgh end of the canal two basins were provided—one, Port Hopetoun, for passengers and goods, together with offices, ware-



EDINBURGH AND GLASGOW UNION CANAL.

Longitudinal section from Port Hopetoun (Edinburgh) to the junction with the Forth and Clyde Canal at Falkirk.

houses, etc., and another, Port Hamilton, which is understood to have been used mainly for the coal traffic.

Having regard to all these conditions, it is not surprising to learn that the actual cost of construction far exceeded the original very moderate estimate of £235,000. By the time the canal was opened, the expenditure had amounted to £400,000. So much, also, still remained to be done, before the canal could be regarded as in good working order, that within the next four years the total cost of the undertaking had increased to £600,000. By their first Act, the Company of Proprietors were authorized

to raise £240,500 (including the £200,000 then already subscribed), and a further sum of £50,500—should it be wanted. Between 1819 and 1826 they had to obtain a succession of fresh Acts in order to raise more capital from time to time.

PASSENGER TRAFFIC.

If, again, the cost of construction had been under-estimated, the probable revenue had been over-estimated. The latter had been put at £55,000 per annum. In the first seven years it was less than £17,000 per annum. The passenger traffic, at least, attained to considerable proportions.

Reference thereto has already been made in Chapter V. (See pp. 121–2.) In addition to the journeys by road taken by the coaches between Edinburgh and Glasgow, those cities were also served by two water routes. Persons making the westward journey could go by steamer from Leith along the Forth to Grangemouth (twenty-four miles), and thence either walk or take the small boat plying between Grangemouth and Lock 16 (four miles), where they would join the regular passenger boats on the Forth and Clyde Canal for the remainder of the distance (twenty miles) to Glasgow. Passengers by the Union Canal route left that waterway at Port Downie in order to avoid having to pass through the eleven locks, and they were conveyed, with their luggage, by coaches or other vehicles to the Forth and Clyde Canal boats. In "The Pocket Guide to the Picturesque Scenery of Scotland" (Glasgow, 1836), it is said in reference to these Edinburgh-Glasgow coach and water routes:—"Many tourists, especially those with families of children, prefer canal conveyance betwixt the two cities"; while the 1825 edition of "The Steamboat Companion" says of the passenger boats on the Union Canal that they were "fitted up solely for the convenience of passengers, each having two roomy cabins with every convenience." The canal became, in fact, a formidable competitor of the Edinburgh-Glasgow stage coach.

The following copy of an advertisement issued by the Canal Company will give an idea of the arrangements made in respect to the passenger traffic:—

The UNION CANAL PASSENGER-BOATS

leave PORT-HOPETOUN (EDINBURGH) DAILY,

For GLASGOW at 7 o'clock Morning, 10 o'clock Forenoon, 1 o'clock Afternoon; and leave GLASGOW for EDINBURGH at the same Hours.—Cabin, 6s.; Steerage, 4s.

For FALKIRK, LINLITHGOW, and all intermediate places on the Canal, at 7 o'clock Morning, 10 o'clock Forenoon, 1 o'clock Afternoon, and 5 o'clock Evening; and from the HEAD of the LOCKS near FALKIRK for EDINBURGH, at 6 o'clock Morning, 11 Forenoon, 2 Afternoon, and 5 Evening.—Fare to Falkirk, Cabin, 3s.; Steerage, 2s.

For STIRLING, BRIDGE OF ALLAN, DUMBLANE, CRIEFF, and PERTH, at 10 o'clock Forenoon; and from PERTH at 7 o'clock Morning; CRIEFF at 9 o'clock Morning; and from STIRLING at half-past 12 o'clock Afternoon.

FARES.

EDINBURGH to STIRLING, Cabin of Boat, and Inside of Coach, 5s. : Steerage of Boat, and Outside of Coach, 3s. 6d.—EDINBURGH to CRIEFF, Cabin of Boat and Inside of Coach, 11s. Steerage of Boat and Outside of Coach, 8s.—EDINBURGH to PERTH, Cabin of Boat and Inside of Coach, 15s. : Steerage of Boat and Outside of Coach, 10s. 6d.

The CANAL OMNIBUS leaves No. 25 Prince's Street, Edinburgh, for Port-Hopetoun, *Ten Minutes before the Hour of each Boat sailing* : and also waits the arrival of the Boats.—Fare 3d., and 1d. for each bag or Portmanteau.

TICKETS for GLASGOW, FALKIRK, LINLITHGOW, and STIRLING, sold at No. 25 PRINCE'S STREET, and at the CANAL OFFICE.

Passengers are requested to address their Luggage and to attend to it, as the Canal Company will not be responsible for any Parcel or Package beyond the value of Ten Shillings Sterling.

N.B.—The BOATS Travel at the rate of 9 Miles an Hour. A Quarter of an hour is allowed at LOCK No. 16 for Breakfast or Refreshments. BOATMEN and COACHMEN entirely paid by the Proprietors.

UNION CANAL OFFICE, *August 1st, 1834.*

At Lock No. 16 on the Forth and Clyde Canal, where the stoppage for breakfast or refreshments, as here referred to, was made, there was set up a hotel which, as the result of the traffic on the Forth and Clyde and the Union Canals, in combination, became one of the best-known places of the kind for travellers in Scotland at that period.

For day trippers who could not make such long excursions by boat and coach, in combination, as those set forth in the foregoing announcement, provision was made on such lines as the following :—

DELIGHTFUL EXCURSION.TEN MILES FOR SIXPENCE.

The beautiful Light PLEASURE BOATS of the Union Canal Company leave the Basin, Port-Hopetoun, on PLEASURE TRIPS daily to SLATEFORD, RATHO, and ALMOND AQUEDUCT, at

8 o'Clock Morning ; 12 o'Clock Noon ; and 4 o'Clock Afternoon.

And leave Almond Aqueduct on their return at

10 o'Clock Forenoon ; 2 o'Clock Afternoon ; and 7 o'Clock Evening.

FARES.—CABIN, *Ninepence.* Other Seats, SIXPENCE.

The Scenery along the Canal is of the most pleasant description. The Great Aqueducts at Slateford and Almond, carrying the Canal across extensive Valleys, are highly interesting ; and it is intended to entertain Visitors every Wednesday and Saturday, during the Month of June, by exhibiting the Fall of Water from the Almond Viaduct into the River below, at a Quarter before Two o'clock precisely.

The Starting Point at Edinburgh is accessible by the New Approach at the back of the Castle, as well as by Prince's Street and by Lauriston.

Fruits, Confectionaries and Varieties of Refreshments, to be had at Almond Aqueduct.

June, 1834.

Among the regulations issued from time to time for the observance of passengers was the following :—

NOTICE.

NO SMOKING allowed in any of the Union Canal Company's Passenger boats.

No Person under the influence of Liquor shall be received on Board. If it shall be discovered that there is on Board any such Person, or any Person riotous or using improper Language, or who annoys others, such Person shall be put on Shore at the First Stables.

Passengers are requested not to reach over the Windows or Sides of the Boat, as doing so puts the Boat out of proper sailing trim.

No Person permitted to sit or stand outside the Steerage if there be room inside.

CANAL OFFICE, EDINBURGH, *May*, 1844.

MINERAL AND GOODS TRAFFIC.

In respect to mineral and goods traffic, the canal served a useful purpose from the point of view of the citizens of Edinburgh, by assuring to them a good supply of coal from the Lanarkshire coalfields at cheaper rates than they had previously paid. It also formed a convenient means for the consignment of heavy goods to destinations in the west country.

Special attention was naturally paid by the company to their coal traffic, and every effort was made to encourage its expansion. One public announcement, for example, which they issued was to the following effect :—

COAL-WEIGHING.

UNION CANAL.

THE Public are respectfully informed that, by means of the Weights and Sworn Weighers established by the Canal Company, there is afforded the most perfect security in regard to the correct Weight of coal furnished by the Canal Merchants. For a long course of years the Regulations and Arrangements of the Canal Company have been found so entirely satisfactory, that no instance of even an attempt at fraud has for many years been known to occur ; and the Public are requested to notice, that not only is the Weight of each Load certified under the hand of the Sworn Weigher, but also the quality of the Coal furnished is denoted by a Stamp impressed by the Weigher on every Coal Ticket.

CANAL OFFICE, EDINBURGH, *December*, 1841.

In a further announcement (undated) it was said :—

TO PRIVATE FAMILIES AND PUBLIC ESTABLISHMENTS.

Coals of first quality reduced to 8/6 per ton.

THE UNION CANAL COMPANY call the attention of the Public to the advantages enjoyed by Consumers of the Canal-borne Coal, with reference to the unprecedented lowness of the present price—*the absolute certainty as to the kind of Coal furnished,—and the complete assurance of the full and entire weight.*

The *first-rate Coals* are now *delivered at the Consumers' Door* at THE VERY LOW PRICE OF 8s. 6d. PER TON, including cartage. These Coals afford a great choice of quality, and being all freshly imported, deserve the attention of every Private Family and Public Establishment.

Each load of Coals is accompanied by the Certificate of one of the *Sworn Weighers*, (persons selected for their steadiness of character, and sworn to fulfil faithfully the trust committed to them), *certifying the weight of Coals sent*, and thus *assuring full weight*.

Further, there is impressed (also by the same weigher) a stamp on the Certificate, *denoting the kind of Coal sent*, and thus giving *assurance of the quality*.

A HOPELESS OUTLOOK

At one time five boats for passengers and parcels were leaving Edinburgh for Glasgow every week-day, at 6, 8 and 10 a.m., 12 noon, and 2 p.m., supplemented by three night boats, carrying both passengers and goods, at 6, 8 and 9 p.m.; but with the opening of the Edinburgh and Glasgow Railway in 1842, there set in for the canal a period of decline from which it was never to recover.

The passenger traffic felt the competition keenly from the very outset. Guide-book writers might become eloquent in describing the attractions of the scenery *en route*, and the canal company might seek to mitigate the possible discomforts of winter journeys on water by assuring the public that "both cabins are comfortably heated"; but when the majority of prospective passengers found that the train would take them to their journey's end in so much less time than the canal boat, they chose the former and discarded the latter.

In their efforts to hold their own, the canal company announced successive "Great Reductions in Fares," and offered an assurance of "Safety! Comfort!! Economy!!!" to those who would still patronize their "Swift Passenger Boats" instead of discarding them for the railway, on which, inferentially, these threefold advantages would not be found. On February 21st, 1842, the previous fares between Edinburgh and Glasgow of 6s. cabin and 4s. steerage were reduced to 3s. 6d. first cabin, and 2s. 4d. second cabin. In July, 1843, the first cabin fare became 3s. and the second cabin fare 2s. Still the traffic declined, and a year later the fare by the first cabin was further reduced to 2s. 2d., and the second cabin fare to 1s. 4d., while travellers who were content to go by the night boats for passengers and goods could make the journey to Glasgow for 1s. 4d. first cabin, or 1s. 2d. second cabin. Yet even with the offer of such reductions as these, the people who failed to take advantage of the quicker travel by rail were comparatively few in number.

Nor was the outlook in regard to goods and minerals any more promising than that in regard to passengers. The canal, as we have seen, was originally designed for the purpose of facilitating the coal supply for the people of Edinburgh; but the opening of the new railway led to such announcements as the following:—

EDINBURGH AND GLASGOW RAILWAY.
COALS.

JAMES MACNAUGHTON begs leave to inform the Inhabitants of Edinburgh, that he has taken advantage of the facilities afforded by this Railway for bringing into Town, in a fresh State, the COAL of the Redding coalfield.

The Coals derived from that field are of the first quality; and as the Railway affords the means of procuring the Coal fresh from the pits every day, both in summer and winter, J. M. is confident that his Establishment, at the Railway Depot, Hay Market, has only to be tried, to be found to supply an article superior to any yet brought into Edinburgh.

* * * * *

EDINBURGH AND GLASGOW RAILWAY DEPOT,
HAY MARKET, *October 4th*, 1842.

Even before the opening of the railway, the total amount of goods and mineral traffic carried on the canal was considerably less than had been anticipated, with the result that, setting the smaller revenue against the greater expenditure on construction than had been allowed for in the estimates, no prospect of profit was left for the shareholders.

Now that railway competition had to be faced, in addition, the outlook for the canal shareholders speedily became hopeless.

Significant of the conditions into which the undertaking was drifting must have been the following public announcement:—

HORSES FOR SALE.

TO BE SOLD, by Public Sale, at *Mr. Laing's* Repository, Lothian Road, Edinburgh, on *Wednesday, 6th November*, at One o'Clock Afternoon

10 WELL-SEASONED HARNESS HORSES,

The Property of the Union Canal Company, all newly off Work, and suitable for Coach Proprietors, Postmasters, and others.

EDINBURGH, *28th October*, 1844.

Soon it became a matter, not only of selling off the now surplus horses, but of disposing of the canal itself; and, after a few more years of hopeless struggle, the shareholders were quite ready to assent to the disposal of the undertaking to the Edinburgh and Glasgow Railway Company.

TRANSFER TO RAILWAY OWNERSHIP.

The transfer was effected by an Act "for vesting the Edinburgh and Glasgow Union Canal in the Edinburgh and Glasgow Railway Company," which received the Royal assent June 26th, 1849. In the preamble it was stated that the canal, which had been open for the use of the public for over twenty-five years, was completed at an expense greatly exceeding the estimate; that, since its completion the Edinburgh and Glasgow Railway had been constructed through the same district, in nearly the same line as the canal, and partly on the lands of the canal company; that vessels could pass between Leith, the port of Edinburgh, and Glasgow by the Forth and Clyde Navigation; that the canal had to

compete with two lines of railway—the Caledonian as well as the Edinburgh and Glasgow; and that, since the opening of the latter line, the revenue of the canal had been little more than sufficient to pay the cost of maintenance and to meet the interest on debts incurred, without allowing for any dividend to be paid or for any return to be made for the capital invested by them. Therefore, the preamble continued, it was expedient that the canal should be vested in the Edinburgh and Glasgow Railway Company, on terms mutually agreed upon. The sum actually paid was £209,000.

Had it not been for this transfer, it is extremely doubtful if the canal could have survived the unfavourable conditions by which its operations were to be attended; though no evidence is now available as to the reasons why the Edinburgh and Glasgow Railway Company should have thought it worth while to acquire the canal at all.

In any case the effect of vesting the undertaking in a railway company, under an Act of Parliament, was to ensure, not only its continued existence, but its effective maintenance, regardless altogether as to whether such company gained any advantage from its ownership or not. Under Clause XXV of the Act of 1849, the Edinburgh and Glasgow Railway Company were required to keep the canal in good working order and condition and preserve the same supplies of water as before, so that the canal and every part thereof might at all times be open and navigable for vessels of the same burden as those ordinarily using it at the time of the passing of the Act. In the event of any failure on the part of the company so to do, it would be lawful for the Commissioners of Railways, on complaint being made to them, and following upon inquiry and examination, to do the necessary work and take steps to enforce payment of all costs, charges and expenses by such party and in such manner as they might order.

When, in 1865, the Edinburgh and Glasgow Railway Company was amalgamated with the North British, these statutory obligations in respect to the Union Canal devolved, in turn, upon the latter company.

In 1888 the amount of traffic carried was 129,000 tons. In 1898 it was 112,000 tons. In 1905 it fell to 100,000 tons, of which 27,000 tons were coal, 36,000 tons stones, 26,000 tons manure, 10,000 tons bricks and 1,000 tons sundries.

WHY THE TRAFFIC DECLINED.

The district through which the Union Canal was made is only sparsely populated; but, on the other hand, it counts as a very important industrial one, being, indeed, reckoned as the greatest oil district in Scotland. Certain portions of it form a region of great works which receive or forward thousands of tons of raw or manufactured material every year, and the conditions would seem to be ideal for the patronage of a canal situate in close proximity to the said works even when it does not immediately adjoin them. Nor can it be said that there has been any inefficiency shown in the maintenance of this 5-ft. deep canal, which offers a perfectly

clear run, all on the same level, from the said industrial district into the very heart of Edinburgh.

The canal is certainly subject to weeds ; but the North British Railway Company maintain a dredger on it for the purpose of keeping the weeds down and clearing certain sections which otherwise might get silted. The company have further done what they could to encourage traffic on the canal by putting specially low rates into operation from time to time. From the Candie and Redford collieries to Causewayend basin they were, for instance, authorized to charge a rate of $10\frac{1}{2}d.$ per ton for coal conveyed by the canal ; but, in order to increase the business done, they reduced the rate to $6d.$ per ton, or 43 per cent. below their charging powers. It was not likely that they would have done this had they wished to drive the traffic off the canal on to the railway ; but no increase of traffic followed. Traders were ready to send coal direct to Edinburgh by train when it could be put into the wagons at the collieries, and so carried straight to destination ; but they were not prepared, first to load the coal into wagons, and then have it conveyed to the canal basin, where it would be shot out of the wagons into the canal boats, from which it would afterwards be transhipped for conveyance to final destination—a procedure which meant more labour and greater depreciation in value with each fresh handling. Another reason for the falling off in traffic is that a number of collieries which did formerly consign by the canal have become exhausted.

As regards the almost complete neglect of the canal-transport facilities by works located in the district, the Royal Commission on Canals and Waterways were told by Mr. William Andrew, then (1907) Chief Goods Manager of the North British Railway :—

There are several causes which operate seriously against canals being a satisfactory means of communication except in special cases. Canals cannot be taken into works the same as railways. Railway lines can be laid into the different parts of works, so that the traffic can be loaded into or discharged from the wagons at the particular parts of the works where the material is required or from where it is despatched. Our experience is that railways are preferred to connection by canal, and we have not been able to develop the traffic along the canal. In the case of the Broxburn Oil Works, although quite close to the canal they prefer to get sidings right into the various parts of their works, and practically the whole of their traffic is received and forwarded by railway.

Experiences of the North British Railway with the Union Canal had thus closely followed those of the Caledonian Railway Company with the Forth and Clyde Navigation.

Mr. Millar, then General Manager of the Caledonian, told the Royal Commission that the traffic on the Union Canal was “ a very small thing ” ; he described the canal as one that passed through a district well served by the North British Railway system ; he stated that the only traffic exchanged between the Union Canal and the Forth and Clyde Navigation was an occasional boat of road metal, and he declared that there could be no justification for spending money on the enlargement of the canal on account of either present or prospective traffic.

The Royal Commission evidently endorsed this view since they refrained even from mentioning the Union Canal in their "Recommendations."

The decline in traffic spoken of by the witnesses examined by the Royal Commission has been continuous ever since. In 1913—to take the last year of normal conditions before the outbreak of war—the total was 65,118 tons—a decline of 34,882 tons as compared with 1905. (See p. 168.) The revenue was £2,283 in 1905, and £1,358 in 1913.¹ The number of boats on the whole canal at the end of 1905 was fifty-six. At the end of 1913 it had fallen to forty. When, under war conditions, the North British Railway Company were being called upon to deal with more traffic than they could handle on their lines, they would have welcomed the transfer of a substantial portion of it to their Union Canal. Most of the works, however, which had so long preferred to depend on the railways had no facilities available either for direct loading into, or direct unloading from, canal barges, even when the canal was close at hand, or for dealing with the traffic when they were some distance from the canal. Had they possessed these facilities, they would still have experienced a difficulty in getting a sufficiency of barges, the number of which was limited and could not then be increased.

So it was that, even in war-time, and at a period of more or less traffic congestion on the railways, the very small amount of business done on the Union Canal consisted mainly of city refuse sent from Edinburgh to inland farms, and return cargoes of bricks, fire-clay goods, coal or paving stones.

Nor has there been any improvement under post-war conditions, the traffic figures for 1921, compared with those for 1913, being as follows:—

YEAR.	TRAFFIC. TONS.	REVENUE. £	NO. OF BOATS ON CANAL.
1913	65,118	1,358	40
1921	19,633	1,169	32
Decrease	<u>45,485</u>	<u>189</u>	<u>8</u>

The nature of the traffic still carried will be seen from the following statement for the six months' period from January to June, 1922:—

DESCRIPTION OF TRAFFIC.	TONS.
Coal and Coke	2,466
Road Stone	2,094
Manures	1,162
Building Material	1,068
Miscellaneous	24
	<u>6,814</u>

¹The figures given in respect to revenue relate entirely to revenue from traffic. A considerable further revenue is derived from water supplied to various parties or localities, as well as on account of rents from properties, etc.

A PARTIAL CLOSURE.

The opening of the Union Canal in 1822 led to an early change in the character of the neighbourhood in which its eastern terminus, then "near Edinburgh," was situated.

Buildings had to be provided and various facilities furnished for dealing with the traffic to be handled ; business people found it convenient to have warehouses, sheds and offices in proximity to the waterway, and before long there were the beginnings of an industrial community concerned, in the first instance, in the working of the traffic on the canal, though soon swollen by additions from the trading, artisan and labouring classes in general. As Edinburgh increased in population this once rural suburb, having no more than a few scattered houses surrounded by green fields, was completely absorbed within the limits of the city, and the first or last section of the canal, with its two basins, Port Hopetoun and Port Hamilton, became the centre of a congested district forming one of the most thickly-populated areas within the city boundaries.

Port Hopetoun itself is just over a quarter of a mile from the west end of Princes Street, and it lies immediately to the south of the Caledonian Railway Company's passenger and goods stations. The canal area is contained within the irregular parallelogram formed by Morrison Street, Lothian Road, Fountainbridge and Gardner's Crescent, and the land thus occupied should, having regard to its nearness to almost the very centre of the city, be of exceptional value and importance. Yet half a century ago Port Hopetoun was described as "one of the most hideous features of Edinburgh"; and it can hardly be said to have improved in appearance since then. If Princes Street is, indeed, entitled to rank as "the finest street in Europe," nothing more complete as an anti-climax thereto could be imagined than Port Hopetoun, situated only a few minutes' walk away.

Picturesque considerations, however, are not all. Port Hopetoun necessarily forms a "blind alley" for the Edinburgh end of the canal, and it is unaffected either by tides or by locks, although water is constantly drawn off at a slow rate by pipes affording supplies to railway stations and works in the neighbourhood of Edinburgh. Then the stretch of canal leading immediately to Port Hopetoun crosses Fountainbridge on what is practically the street level ; so that when a barge goes into or comes out of the basin all the traffic along this busy thoroughfare has to be held up whilst the bridge, which is only a few feet above the level of the water, is raised to allow the vessel to pass. Adding to all this the fact that the canal terminus and its basins occupy a site capable of being much more usefully employed for other purposes, one gets a sufficiently long list of local grievances against an ancient waterway which, after all, does not seem to be very much wanted.

Schemes for the remedy of the various disadvantages thus experienced have been proposed from time to time, included among them being one brought forward in 1910 by members of the Executive Committee of

Citizens of the City of Edinburgh, who sought to obtain an Edinburgh Canal District Improvement Provisional Order designed to create a Trust which, among other things, would have closed the canal basins at Port Hopetoun and Port Hamilton and removed the terminus of the canal from the city of Edinburgh to a new basin to be constructed at Slateford, about a mile and a half nearer to Falkirk.

To these proposals the Edinburgh Corporation offered various objections, among them being one which related to their own financial interests in the canal.

Under the arrangement mentioned on p. 160, the penny per ton toll which, in accordance with the original Act, the Corporation of Edinburgh was to receive on all commodities, except manure, landed from the canal within a distance of one mile of the eastern terminus, brought them in an average of £529 per annum for a period of fifteen years prior to 1849, when the transfer to the Edinburgh and Glasgow Railway Company took place; though the Corporation then obtained a guarantee that the payment to them of the same toll should be continued as before. On the 1910 scheme being projected, they put in a claim for compensation on account of the prospective loss of this annual payment which, capitalized on a 3 per cent. basis, would have been equivalent to a sum of £17,650. The Corporation further opposed the scheme on the ground that in other directions, besides, their statutory functions would be superseded by certain of the powers asked for by the promoters. These proposals, in effect, became abortive and were eventually abandoned.

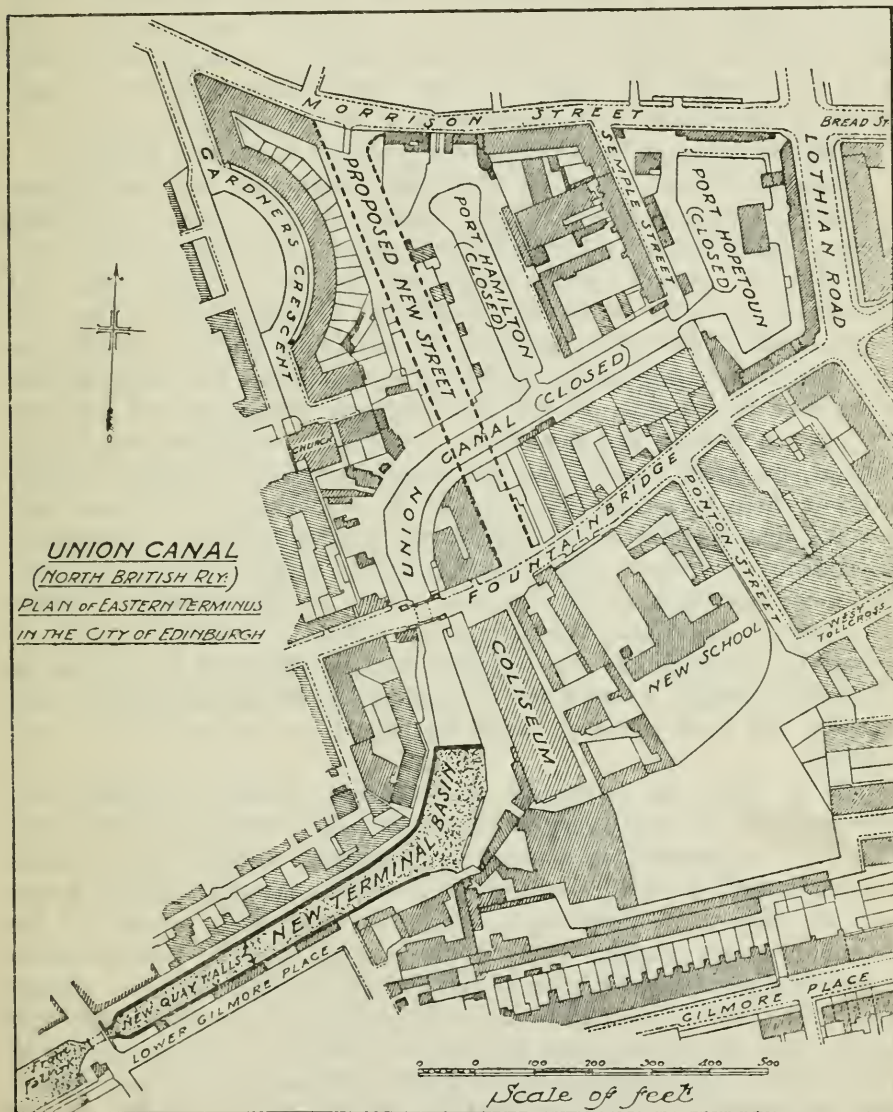
They were succeeded towards the end of 1912 by an agreement which, subject to the approval of Parliament, was made between the Corporation of Edinburgh and the North British Railway Company. Under it the company were to close the canal from a point south of the lifting bridge carrying Fountainbridge Street over the canal (see plan on p. 173), fill up the canal north of this point, together with the two basins, and construct in place of the latter a new terminal basin, this being done under such conditions as would permit of the said new basin being emptied and the water changed from time to time. The company were further to take all reasonable steps with a view to maintaining the water in a pure condition.

Within the area of the portions of the canal thus to be abandoned, the company were to surrender to the Corporation certain strips of land for street widenings or other purposes, and they were also to adhere to a new building line in their development of frontages to Lothian Road and Morrison Street.

In addition to this, the Corporation were to have the option of constructing a new street, not exceeding 60 ft. in width, between Fountainbridge and Morrison Street.

As a contribution towards any loss sustained by the company through being deprived of the two existing basins, as well as towards meeting the costs and expenses they would incur in filling up those basins and providing the new one, the Corporation undertook to pay them a sum of

£25,000 in three instalments, namely, two of £10,000 each, and one of £5,000; though if, within a specified period, the Corporation failed to avail themselves of the option to construct the new street in question, the



EDINBURGH AND GLASGOW UNION CANAL.

Port Hopetoun, the original terminus, Port Hamilton, by which it was supplemented, and the short section of canal leading immediately thereto, have now been closed, and a new terminal basin is being constructed at the point shown on the plan.

last instalment of £5,000 would not be payable and the option would lapse.

This agreement was confirmed by Parliament in an Act which became law on August 15th, 1913, and the various works, naturally delayed in consequence of the war, are now in course of being carried out, though

up to the time that these lines are being written, the Corporation have not announced their intentions with regard to the proposed new street.

That the changes thus being made will effect a public improvement from every point of view—and this, also, without diminishing in the slightest degree such useful purposes as a century-old waterway may still serve—must be admitted by every one concerned; though there would seem to be nothing to suggest that the canal itself is likely to be used to any greater extent in the future than at present, or, indeed, that continuance of decline in the traffic it carries will be in any way checked.

Suggestions have been made from time to time that the North British Railway Company should obtain Parliamentary powers authorizing them to fill in the canal and utilize the ground it occupies for the construction of a line of railway as a relief line between Edinburgh and Falkirk in the interests of their Edinburgh-Glasgow traffic. This proposal, however, has never matured, the fact being that no necessity for the provision of any such relief line has yet arisen. The North British already have two most efficient lines between Edinburgh and Glasgow, the one *via* Falkirk and the other *via* Bathgate, and these are, for the present, at least, equal to all the requirements of the traffic offered, without there being any real need for the conversion of the canal into a third line of railway at what would necessarily be a considerable expenditure of money. The prospects of any such conversion are, also, the more uncertain to-day because, under the improvement scheme now being carried out, Port Hopetoun and Port Hamilton would no longer be available for the terminal station which, if the suggestion originally brought forward for the utilization of the canal for a new railway had been adopted, would have been set up on the site they occupy.

If, in 1849, the Edinburgh and Glasgow Railway Company had refrained, as they might very well have done, from taking over the Union Canal—then obviously in a moribund condition—and had left it to its economic fate, it would doubtless have died a natural death long ago, and the citizens of Edinburgh would then have been relieved of the terminal eyesore of which they are only now getting rid. But the action taken by the railway company of that day had so little effect in “strangling” the canal (to use the word popularly applied to transactions of this kind), that the actual result was to bind them and their successors in possession to keep it going and in good condition for all future time—and this regardless of the fact that, as we have seen, the *traffic* revenue had sunk by 1921 to but little over £1,000.

PART IV.—FORTH AND CLYDE SHIP CANAL SCHEMES.

CHAPTER IX.

THE CANAL MOVEMENT OF 1888.

WHAT may be regarded as the modern revival of the long-projected schemes for a Mid-Scotland Ship Canal, allowing of the passage of sea-going vessels from ocean to ocean, was mainly attributable to the public interest aroused, and the high expectations formed, in regard to the Manchester Ship Canal, the first sod of which—following on a prolonged agitation—was cut in November, 1887.

For some years subsequent to this event—and more especially so in 1888—there was an approach, not merely to a canal, but to a ship-canal, mania. Schemes affecting almost every part of the United Kingdom were either revived or projected; conferences and congresses on inland navigation were held; innumerable articles appeared in the Press; pamphlets advocating particular projects were issued; most of the leading engineers in the country seemed to be engaged on preparing plans for new or improved canals; leagues, associations, provisional committees, syndicates and companies of projectors were formed; elaborate official statistics on canal operation were compiled; deputations waited on the Board of Trade; persistent efforts were made to induce Parliament to take action, and there was a wide-spread impression that our economic future would be well assured if only sufficient money were spent on inland waterways.

In the Midlands, for example, no fewer than four schemes for converting Birmingham into a seaport were under discussion in 1888. One of these proposed to give Birmingham direct connection with the port of Hull, via the Trent Navigation. Another showed preference for a ship-canal linking up the Midlands with the Thames. A third aimed at inducing the corporations of Birmingham, Gloucester, Worcester and other Midland towns, together with Cardiff and Swansea, to combine in purchasing and improving the Worcester and Birmingham and the Gloucester and Sharpness Canals, and to undertake various other works, as well, at a total cost of close on £2,000,000, in order to give Birmingham and the Midlands the equivalent of a ship-canal outlet to the Bristol Channel. As an alternative to these three schemes, there was still another which was designed, by an expenditure of £3,000,000, to connect Birmingham with the port of Liverpool by the construction of an entirely new waterway to Winsford, where the Weaver Navigation was to be joined, access being obtained thereby to the Manchester Ship Canal and the Mersey. The Birmingham Town Council appointed a Ship Canal

Inquiry Committee to investigate these various projects ; but nothing came of any of them. The climbing down from an elevation of 453 ft. at Birmingham to sea level was, in itself, a sufficiently serious engineering proposition, while, as regards financial aspects of the question, an article published in *The Times* of September 15th, 1890, specially favouring the Birmingham-Liverpool scheme, and showing that the others were more or less impracticable, said :—

The financial part of the problem is very far from being solved yet, and if the mercantile public of the Midlands are in earnest in their professed desire for waterway communication with the sea-board, they will have to give more practical evidence of their faith in, and sympathy with, the project than is at present forthcoming.

The “ practical evidence ” was *not* forthcoming, and all four schemes were dropped for the time being.

In 1888, also, the Sheffield Chamber of Commerce appointed a committee—which included manufacturers, landowners and coal-owners—to inquire into a proposal for improving the waterways between that town and the port of Goole. Another Yorkshire scheme was for a ship-canal between Leeds and Goole. On the west coast, an Irish Sea and Birkenhead Ship Canal Company was formed to carry out a project on which Telford and Robert Stevenson had reported as far back as 1838.

More in keeping, however, with the idea of a cross-country sea-to-sea canal was the proposal, also brought forward in 1888, which aimed at connecting the Bristol Channel with the English Channel by a ship-canal starting at Stolford, Bridgwater Bay, continuing via Taunton, and entering the English Channel at Seaton, on the South Devon Coast. If one looks only at the map, this short cut for sea-going vessels will appear an eminently desirable enterprise since, if it could be made, it would mean the substitution of a direct route of forty-five miles for one of some 300 miles round Land’s End, with its attendant risks. A like project was, in fact, under discussion in 1824, when, by direction of a company of promoters, Telford reported on a canal by this route, designed to accommodate vessels of 200 tons when fully loaded.¹ He proposed that it should be 95 ft. wide at the top, have a depth of 15 ft. and be provided with locks 125 ft. in length and 30 ft. in breadth. It was, however, just these locks that presented the greatest difficulty. An elevation of about 250 ft. above low water in the two channels had to be overcome, and this was to be done by means of thirty locks. These physical conditions were regarded in 1824 as fatal to the project, and the revival of the scheme in 1888 led to no better results.

Public interest at the latter date in canals and inland navigation was further shown by the holding at the Society of Arts, London, on May 10th and 11th, 1888, of a conference, presided over by Sir Douglas

¹ “ Ship Canal for the Junction of the English and Bristol Channels. Reports of Mr. Telford and Capt. Nicholls. Published by Order at the general meeting of subscribers.” Map. London, 1824.

Galton, at which no fewer than fifteen papers on various aspects of the subject were read or presented.

There was found to be, however, a great need for definite information as to the number, length, construction, ownership, capital, traffic, etc., of existing canals in the United Kingdom, and when Parliament was passing the Railway and Canal Traffic Act, 1888, it included therein (section 39, sub-section 2), the requirement that—

Every canal company shall within such time as may be prescribed by the Board of Trade, and afterwards from time to time whenever required by the Board of Trade, not being oftener than once in every year, forward to the Board of Trade in such form and manner as the Board may from time to time prescribe, such returns as the Board of Trade may require for the purpose of showing the capacity of such canal for traffic, and the capital, revenue, expenditure, and profits of the canal company.

Canal Returns corresponding to the Board of Trade Railway Returns were published in the summer of 1890, a few weeks prior to the meeting in London of the Fourth International Congress on Inland Navigation, which brought together waterway experts and authorities from many different countries.

In regard to deputations, there was one from Shropshire that waited upon the President of the Board of Trade, Sir Michael Hicks-Beach, in May, 1888, to represent the urgent desirability of improving canal communication between the Midland Counties and London, Liverpool, Hull and other ports; and there was another which, representing the Associated Chambers of Commerce, waited on the same Minister, in the following November, to advocate the extension of the canal system of the United Kingdom and to suggest, more specifically, that the State should take over the canals in order to manage and control them on unified principles—a proposal which Sir Michael met with the reply that “they must not take it for granted that a mere change in the ownership of canals would do everything they desired.”

In February, 1889, Mr. Philip Stanhope, M.P. for Wednesbury, introduced into the House of Commons a Canal Development Bill which proposed to confer upon certain local authorities the power to construct, enlarge and manage canals, such power to be obtained by means of a Provisional Order, to be granted by the Board of Trade, and to be submitted to Parliament for confirmation. The Bill was read a first time and then dropped. It became a “hardy annual,” but never had any chance of becoming law.

Simultaneously with all these inland navigation projects, proposals and controversies, much was being said, written, or done in regard to the subject of national defence; and in June, 1888, the hon. secretary of a Forth Defence Committee, then in active operation, sent to the Admiralty and the War Office letters in which it was suggested that “the present time”—when the whole question of national defence was being reconsidered—might be regarded as opportune for paying more attention to the ports on “the most important estuary on the north coast of Britain.”

The committee further urged upon the Admiralty that the character and position of the Firth of Forth offered sound reasons for special regard being devoted to its defences.

Such was the period wherein there was brought about a revival of that scheme for a Mid-Scotland Ship Canal which, as we have seen, had originally been projected in the reign of Charles II.

CHAPTER X.

FORTH AND CLYDE SCHEMES REVIVED.

THE desirability of constructing a ship canal across Central Scotland had already been referred to in the Press in the early days of that ship-canal movement which, starting in Manchester, seemed to be arousing interest and leading to fresh projects not only in the United Kingdom but all the world over. On May 19th, 1884, *The Times* published a leading article on a proposal then being discussed in France for the building of a canal for ocean-going vessels of the largest type from the Gironde to Narbonne, thus affording a short cut between Bordeaux and the Mediterranean, and, incidentally, converting Spain and the portions of France adjacent thereto into an island. The article began:—

Engineers long since gave the isthmuses of the world notice to quit. Wherever there is a neck of land its final cause, in the engineering judgment, is to afford an admirable opportunity of being cut. . . . But the supply of isthmuses is short. . . . Accordingly peninsulas are now warned that their turn is come.

The suggestion here made, that the supply of isthmuses to which engineers could apply their skill was running short, led "A Former President of the Liverpool Chamber of Commerce" to reply (May 26th):—

There is an invaluable isthmus in our own country waiting to be adequately cut through, which, if on German or French territory, it would long ago have been—I mean, of course, the 30-mile wide neck of land that separates the Forth from the Clyde. The shallow waterway excavated there last century was never sufficient for ocean-navigation purposes. It was a private enterprise, which the canal I point to ought not to be. What the nation wants, and should have, is a channel of communication between the two great estuaries which shall be suitable for present-day international commerce by allowing the passage of the largest modern steamers and the leviathans of our Navy, all which, in time of European war (a big calamity that may any week burst forth), could move rapidly and securely from one side of the island to the other, according as circumstances may require. This short cut would practically more than double our home fleet's force, and should be viewed in connection with our miserable deficiency in respect to naval yards and arsenals, of which there is not one in the island north of the Thames on the east coast and of Milford Haven on the west. The national value of the great engineering and shipbuilding establishments on the Clyde would then indeed be incalculable. . . .

I write in the interests of commerce, but also and much more in order to maintain, if possible, the nation's continued pre-eminence as a first-class maritime people and power. Should or could the United Kingdom be regarded as worthy of this noble and responsible position if, with all her wealth, she, for a comparatively paltry saving of money, continues to disregard great and obvious requirements for trade and strength?

No result seems to have followed the publication of this letter in *The Times*, and the Scottish phase of the ship-canal movement was not developed afresh until early in 1889. *The Economist* of December 1st, 1888, had published a leading article on "The Question of Inland Navigation" in which it was said that commercial men in the manufacturing districts had lately been actively discussing the question of inland navigation, and various projects for the extension of canal and river communication had been taken in hand. The first impetus to the movement had, it continued, been given to the movement by the launching of the Manchester Ship Canal Scheme, and that enterprise had induced manufacturers in other districts—especially the Midlands and northern centres far removed from the sea-board—to consider the advisability of improving the existing waterways and of constructing additional canals. The article went on to deal with the numerous schemes and proposals already brought forward in regard to canals and waterways in England but did not refer specifically to Scotland.

A FORTH AND CLYDE NAVIGATION IMPROVEMENT SCHEME.

On January 5th, 1889, the same journal published a letter from Mr. Charles John Wilson, Deanfield, Hawick, N.B., who, after alluding to the ship-canal projects mentioned in the article of December 1st, 1888, went on to say:—

A scheme perhaps more important than any of those enumerated by you would be the widening and deepening of the present waterway which connects the Forth with the Clyde, so that ships of large dimensions could pass from one to the other.

He mentioned some of the leading details concerning the Forth and Clyde Navigation, and proceeded:—

Lord Charles Beresford and other naval authorities have told us that our Navy is not nearly sufficient to defend our coasts in the event of a threatened invasion, and they advise that we should at once spend 20 millions sterling on increasing our fleet.

To make our present ships more available would work in the same direction, and the Forth and Clyde ship-canal would give facilities for the rapid passage of our battleships from east to west or vice versâ, thus making one squadron do the work of two, and have all our ships all the while inside the lines of our fortifications and safe from the attack of the enemy.

It was estimated that the work could be done for £1,300,000. "I feel sure," Mr. Wilson added, "that such a canal would not only be a great national safety but would be a paying commercial speculation."

A fortnight later, Mr. Wilson wrote again to *The Economist* to say that his previous letter had been reproduced in the *Glasgow Herald* and other Scotch newspapers, that it had aroused considerable interest, and that it had brought him many communications. He mentioned some of the suggestions made therein as to the probable advantages to be derived from the carrying out of the proposal; said it appeared to be thought that from £1,500,000 to £2,000,000 would be required, and suggested that there were four questions which required to be answered—

(1) Is the scheme practicable? (2) What would it cost? (3) What are the prospects of traffic? (4) Would it pay as a commercial enterprise?

Following on this, "Ex-President of the Liverpool Chamber of Commerce"—referring incidentally to his earlier letter in *The Times* of May 26th, 1884, and now giving his address as "Dreghorn, Midlothian"—suggested in *The Economist* of January 26th, 1889, that there were two further questions, in regard to the scheme, which might be added, one of these being—"Whether it would pay or not as a commercial enterprise, can the leaders of the nation be blameless who, knowing its inestimable value, or, in truth, nowadays, its vital necessity, for commerce in time of war, and still more for movements of the Navy then, allow the work to be any longer neglected?"

Whilst this correspondence was being followed up in the columns of *The Economist*, there was published in the issue of *Engineering* for January 11th, 1889, an article wherein it was said that the agitation in favour of canals and waterways which had been waged in England for some time back had now been extended to Scotland, where it was proposed to "improve the existing canal between the Clyde and the Forth, so that ships might be able to pass through." The cost of making the canal suitable for deep-sea-going ships was estimated at between £1,500,000 and £2,000,000, and it was contended that, inasmuch as the canal was the shortest route between America and the Baltic, the Continent and the east coast of Scotland, the through traffic would be considerable. The article went on to say:—

This may be true, but the gain in time would be reduced materially by the fact that vessels in coming off the Atlantic would require to sail up the long firth (Clyde), and would probably require, particularly if deeply laden, to wait on the tide to get to Bowling, which is some distance up the river, or the channel would not be broadened and deepened, thus adding to the cost. For Channel steamers going from Ireland or the west coast of Scotland, England or Wales to the east coast or the Continent, the canal would be a decided benefit, for not only would their voyage be shortened but the rocky and dangerous coast of the north of Scotland would be avoided. The canal passes through the coal and oil districts of Scotland—a fact which affords additional argument in favour of the scheme. Another consideration which carries much weight is the facility gained for the rapid passage of battleships from one shore to the other, rendering defence in time of war more effective.

SHIP CANAL SCHEMES PROPOSED.

It will have been seen that whereas "Ex-President of the Liverpool Chamber of Commerce" assumed in 1884 that the Forth and Clyde Navigation could not be converted into a ship canal, and that a new waterway would be necessary, Mr. C. J. Wilson suggested, in his first letter to *The Economist*, no more than a widening and deepening of the existing barge canal, while *Engineering*, in turn, also alluded, in the article just quoted, to an agitation which aimed at securing a like improvement of that canal.

On February 8th, 1889, however, *Engineering* stated that, since the publication of its previous article on the subject, the idea had been

suggested of constructing a new ship canal—that is, in preference to making any attempt to enlarge the Forth and Clyde Navigation. It was proposed to deepen the river Leven from its confluence with the Clyde at Dumbarton to its source in Loch Lomond, and begin the new canal at a point on Loch Lomond near to Endrick Water. Thence the route would pass via Drymen, Buchlyvie and Kippen to Stirling, attaining a height of about 260 ft., followed by a sharp decline. At Stirling the Forth would be joined; but the river would require to be deepened and straightened, by reason of the fact that its widenings made the course from Stirling to the Forth Estuary from thirteen to fifteen miles against five miles on the straight. “The adoption of the present canal for ships is,” the article added, “the scheme most favoured.”

The particular Loch Lomond route here in question was, of course, the one that Smeaton had previously considered and condemned;¹ and the proposals now advanced in respect to it were, in the first instance, no less open to criticism, on the ground that the Forth was to be utilized below Stirling as part of the waterway; but this objection was subsequently met by modifications providing for an entirely new waterway, independent of the river, though still passing for a certain distance through the Forth valley.

A further objection, entertained against any Loch Lomond route at all, was that a ship canal by this route would prejudice the interests of Glasgow, since it would not come nearer to that city than Dumbarton, at least; and an alternative scheme was proposed for the construction of a ship canal which, starting at Grangemouth, would follow a “direct” route, more or less parallel, for most of its length, with the existing Forth and Clyde Navigation—though quite independent thereof—and having its outlet into the Clyde at Yoker, four miles below Glasgow.

This proposal was at first received with such favour that a committee of Edinburgh gentlemen instructed Messrs. D. and T. Stevenson, of that city, engineers to the Northern Lights Commission, to survey the route and prepare a report and estimates. Messrs. Stevenson did so, and drew up a report bearing date August 30th, 1889. They stated therein that the route which first suggested itself to them was, in effect, the “Direct Route” just mentioned; but, finding that the lowest ground along which the canal would pass was about 160 ft. above the level of the sea for a length of some thirteen miles, necessitating a series of locks or hydraulic lifts which would cause great delay in the passing of vessels, they felt that they could not recommend the construction of a ship canal along this line.

THE LOCH LOMOND ROUTE.

The route they did recommend was, in effect, the Loch Lomond route; and it may be convenient to deal with their proposals in this

¹ See pp. 97-8.

direction before telling the story of what was further done in regard to the "Direct Route."

Under the first scheme drawn up by Messrs. Stevenson, they proposed to provide for an eastern approach to the canal by dredging a channel in the Forth to a depth of 34 ft. from deep water just above Rosyth to Alloa, the seaport town on the left bank of the Forth (situate eight miles west of Rosyth and six and a half miles east of Stirling), which tradition had so long pointed to as the eastern terminus of waterway communication between the Forth and the Clyde. At Alloa two locks—only one of which would require to be used at high water in the Forth—would be provided in order to raise vessels at once to the summit level of the canal and the level of Loch Lomond, itself only about 22 ft. above the mean level of the sea. From these locks the canal would continue along the valley of the Forth, keeping in practically the lowest ground as far as Buchlyvie, a distance of twenty miles from Alloa. Up to this point the intervening ground does not attain a higher elevation than from about 30 to 50 ft. above sea level; but it would then be necessary to pass through the "haunch" of Ben Lomond—a ridge extending a distance of about four miles and attaining a maximum height of 260 ft. above sea level. It was proposed to overcome this difficulty by means either of a tunnel or a deep cutting. On the other side of the ridge the canal would enter the Endrick valley—where the land falls away rapidly to about 30 ft. above sea level—and continue along it until Loch Lomond was reached.

In their report of August 30th, 1889, the engineers pointed out that there were three possible exits from Loch Lomond—(1) via Tarbet, on the north-west side of the loch, and thence across a narrow neck of land into Loch Long, which is practically the Atlantic Ocean; (2) via the vale of the Leven, on the south, to Dumbarton and the Clyde, or (3) via Arden, in the south-west corner of the loch, by a four-mile cutting to Ardmore Head, opposite Greenock. Messrs. Stevenson recommended the Tarbet exit, by preference, the two other routes being considered impracticable on various grounds. Facilitated by a deepening between the islands of Inchcruin and Inchfad, vessels using the canal would continue on Loch Lomond a distance of thirteen miles to Tarbet, from which point there would be a deep cutting, one and three-quarter miles in length, to Arrochar, on Loch Long, the land between these two points attaining a maximum elevation of 160 ft. above sea level. At Arrochar two more locks, similar to those at Alloa, would be provided, and, considering that it has a water area of 21,000 acres and a gathering ground of 290 square miles, the engineers regarded Loch Lomond as fully equal to supplying all the water that these four locks—and the only locks on the entire route of the canal—would require. Passing through the locks at Arrochar, vessels would drop down to sea level at Loch Long,—where the canal would debouch into 60 ft. of water—and follow this loch for a distance of thirteen miles to the Firth of Clyde, which would be reached just opposite the Cloch Lighthouse. Vessels for Glasgow would go to that port via Loch Long and the Clyde.

Messrs. Stevenson further proposed, in their first report to the Edinburgh Committee, that the canal should have a depth of 30 ft. throughout ; that the terminal locks should be about 600 ft. long and 80 ft. wide, with smaller ones alongside for smaller vessels ; and that the width at the bottom should be 72 ft. with side slopes depending on the nature of the ground. The cost of a canal of these proportions, and by this route was estimated at £8,000,000. Concerning the scheme as a whole they said :—

Both approaches are in smooth water and free from every danger to navigation. The western outlet into Loch Long we think exceedingly favourable, as vessels of the largest class could at once proceed to sea quite free from the interruption and liability to grounding which they would meet with had the canal debouched into the Clyde. No doubt vessels bound from the North Sea to Glasgow would have to pass up the Clyde to reach their destination, but it is better that these vessels *only* should have to do this than that every vessel bound out of the Clyde or Greenock should be subjected to the interruption from the river traffic, and also to delay occasioned by having to wait for the tide. There is only about fifteen to eighteen feet of water in the Clyde at low water, and at high water spring tides from 25 to 28 ft., whereas vessels would be able to pass from the canal by Loch Long to the ocean at any time with a 30-ft. draught.

They suggested, also, that a canal of the dimensions stated would not only be of great service to the mercantile marine but would accommodate the largest vessels then controlled by the Royal Navy, and allow of their passing from the one coast to the other in about eight hours. A table which they gave, showing comparative distances of the present routes of shipping and the saving that would be effected by the proposed canal included the following examples :—

FROM	To	SAVING IN MILES.
The Clyde . . .	Ports on E. coast of Scotland, N.E. of England and N.W. of the Continent	238 to 529. In majority of cases more than halved.
The Forth . . .	Ports on W. coast of Scotland, N.W. of England, Ireland, America and the Mediter- ranean	141 to 487. More than halved in all cases except America and the Mediterranean.
Tyne Ports . . .	The St. Lawrence River . . .	150.
West of Britain and N.E. of Ireland	Middle Western ports of the Continent	98 to 377.

In regard to these figures it was added :—

But the advantages of the canal are not limited to a saving of distance, the nature of the route being absolutely changed from a dangerous or tempestuous one to an inland navigation absolutely free from danger—decreasing the tear and wear and materially lowering the rate of insurance.

To this report there was appended another, dated October 4th, 1889, by Mr. E. Leader Williams, M.Inst.C.E., chief engineer of the Manchester Ship Canal. Mr. Williams commented on the various benefits likely to be derived from the proposed Forth and Clyde Ship Canal—a work which, he thought, would be of national importance in case of war ;

he considered that, as far as could be judged by preliminary investigation, there would be no insuperable difficulties in constructing the canal of a size that would accommodate the largest class of steam or sailing vessels, and he further wrote :—

The rapid rate at which the works of the Manchester Ship Canal are now progressing towards completion proves that, if a ship canal is designed on the basis of careful surveys, an energetic contractor, with the aid of modern engineering appliances, can construct a large ship canal with the same certainty and speed with which the small barge canals of the last century were made. They are, in fact, similar works, varying only in magnitude and cost.

The committee to which these reports were made endorsed Messrs. Stevenson's recommendations, and on November 20th, 1889, a meeting (convened by the Convention of Royal Burghs) of persons favourable to the construction of a ship canal between the Forth and the Clyde was held in the Philosophical Institution, Edinburgh, for the purpose of considering the report and plans. A resolution declaring "That a ship canal to unite the Forth with the Clyde would incalculably benefit the maritime commerce of the United Kingdom and the North of Europe, be of inestimable value to the nation in the handling of its Army and Navy, and greatly develop and promote national industries," was carried, and a committee was appointed to inquire further into the scheme and report to a future meeting; but no further result then followed and the proposed future meeting was not held.

This initial scheme was, in fact, found to be open to various objections, and it was accordingly subjected to revisions which substituted a deep cutting for a tunnel, allowed for a depth throughout of 31 ft., a bottom width of 100 ft. and terminal locks, of which the larger would be 900 ft. long by 100 ft. wide and the smaller, alongside, 450 ft. long and 45 ft. wide. The estimated cost of the undertaking on these altered lines was £17,000,000.

Subsequently, and as will be shown later on, there were further important revisions of, and changes in, Messrs. Stevenson's plans; but it may now be convenient to revert to the conditions prevailing in the early days of the ship-canal scheme revival, and see what had, in the meantime, been done in other directions.

THE INITIAL "DIRECT ROUTE" MOVEMENT.

In or about September, 1889, the organization at Glasgow of a National Ship Canal League led to the calling into existence of a "Provisional Committee of Promoters of the Forth and Clyde Ship Canal" in the interests, it would seem, of that "Direct Route" in which Glasgow was specially interested; and of this body Mr. J. Law Crawford, a Glasgow solicitor who, in addition to being a member of the Faculty of Procurators of Scotland, was a member of the International Congress on Inland Navigation, became law agent and secretary.

Following on the report made in August, 1889, by Messrs. Stevenson on the Loch Lomond route, the Provisional Committee in Glasgow

instructed Messrs. Crouch and Hogg, civil engineers of that city, to report to them on the feasibility of constructing a ship canal between the Forth and the Clyde, and to furnish an approximate estimate of the cost of such an undertaking. The report so presented bore date May 26th, 1890. As regards the choice between the Loch Lomond and the "Direct" routes, Messrs. Crouch and Hogg said that, after a preliminary examination of the main features of both, they had formed a very decided opinion as to the superiority of the "Direct Route," to which, therefore, they had entirely devoted their studies.

Dealing with this particular route, they went on to say concerning it :—

In our opinion the cost of making a cut free from locks, or other methods of raising vessels, would be quite prohibitory, and at a very early stage of our investigations we abandoned any idea of the kind.

It would thus appear that in 1890 any proposal as to a sea-level canal by the "Direct Route" was considered too ambitious to be attempted, although a sea-water sea-level canal was to be advocated later on. What Messrs. Crouch and Hogg did propose, in this first report, was that the summit level of the canal should be 95 ft. above Ordnance datum, vessels being raised thereto by means of locks in preference to other methods which had been suggested at various times. "The adoption of locks," they observed, "of course involves the necessity of a larger supply of water, and, also, delay in the passage of vessels; but in this respect we are very strongly disposed to think that, even if practicable, any other method of raising vessels would be open to equal, if not greater, objection." The canal, they further proposed, should have a depth of 26 ft. and a bottom width of 100 ft., the surface width varying according to the material. Double locks were allowed for in the estimates, the larger being 600 ft. long and 65 ft. wide, and the smaller 400 ft. long and 40 ft. wide. Each would be subdivided by additional gates. The canal would leave the river Clyde between Clydebank and Yoker and follow along the valleys of the Kelvin and the Bonny Water to the junction of the latter with the river Carron, whence it would run due east to Grangemouth, joining the Forth at the mouth of the Carron. The total length of the canal would be a little over twenty-nine miles. The top level would extend seventeen and a half miles of this distance, vessels being raised to or lowered from this top level by means of twelve locks. The canal would cross six railways, but in only two instances would swing bridges be necessary. The engineers had no reason to doubt the sufficiency of the water supply. They estimated the total cost of the canal at not exceeding £7,000,000.

As the champion, at that time, of the "Direct Route" scheme, Mr. Law Crawford read a paper, giving an account of it, at the International Congress on Inland Navigation at Manchester in July, 1890, and in February, 1891, he published a book on the "Forth and Clyde Ship Canal in Relation to the Development of Commerce."

In this little work of 108 pages, Mr. Crawford brought together many.

facts, figures and considerations dealing with "the leading local, national and international aspects of the case"—and especially the case in favour of the "Direct Route" scheme. Under the head of "Local aspects of the Project," he dealt, first of all, with the effect the scheme would have on Glasgow trade; spoke of the success of allied projects (including the deepening of the Clyde, and, also, the existing Forth and Clyde Canal); described the geological features of the route, and pointed both to the effect a ship canal should have on established industries of the district and to the advantages it should confer on local railways. Under "National Aspects," he made a strong plea for the maintenance of national commerce by means of such cheap transport as waterways might afford; alluded to the dangers arising to national commerce by reason of the passage through the Pentland Firth; gave details as to the extent of the coasting trade and the prospective revenue therefrom for the proposed canal; presented a brief survey of the ship canals of the world, and expressed his view as to the services a Mid-Scotland ship canal would render to the country in the event of war. His "International Aspects" related to the development of international trade and British international trade routes. Mr. Crawford added to the expression of his own opinions the views of many eminent commercial, scientific, naval and military authorities on (1) the present and future condition of commerce; (2) the defences of the United Kingdom, and (3) the influence of waterways in the development of commerce. He gave, by way of appendix, the text of Messrs. Crouch and Hogg's report on the "Direct Route," together with some reports on the minerals of the district, and he further included in his book a large coloured map, a plan and longitudinal section of the proposed "Direct Route" canal, and a vertical section thereof. Altogether, it was an exceptionally informative little volume; and, if the whole scheme, as then presented, came to nought,—as it was fated to do—that result was in no way attributable to any lack of skill and energy on the part of its chief advocate. Such result was due, rather, to inherent shortcomings in the scheme itself.

There had been laid before the International Congress on Inland Navigation, at which Mr. Law Crawford read his paper, a "Notice regarding the Proposed Forth and Clyde Ship Canal" by Mr. David Alan Stevenson, who was unable to attend the congress personally but afterwards printed his own paper and, with it, some "Notes" he had communicated to the secretary of the congress as a contribution to the discussion on Mr. Crawford's paper.

THE SCHEME CRITICISED.

In his "Notice" Mr. Stevenson gave a detailed account of his firm's proposals in regard to the Loch Lomond route, and went on to say that, since their scheme was originally brought forward, what was termed the "Direct Route," following very much the same line as the Forth and Clyde Navigation, had been advocated. The idea seemed to be, he continued, that, were the Loch Lomond and Loch Long route adopted,

the interests of Glasgow would suffer ; but this was a fallacy. The trade of Glasgow would not suffer, as Glasgow was not a mere transshipment port. The canal would, rather, tend largely to increase the shipping into and out of Glasgow, since it would greatly facilitate the transport of merchandise by sea between the great centres of commerce, of which Glasgow was the most important in Scotland. He could not see what advantage the Clyde port would derive simply from the passage through the upper reaches of that river of vessels bound from or to other ports. The line would certainly be " direct " to Glasgow, but it would be no more direct than the proposed line by Loch Lomond, as regarded time, for vessels using it as a through passage from sea to sea.

In criticising the " Direct Route " scheme from an engineering point of view, Mr. Stevenson said that the extension of the canal through the channel of the Clyde from Yoker to Greenock would necessitate the deepening of that river, and the whole cost of this river improvement and its maintenance would probably have to be borne by vessels using the canal. Vessels going up the Clyde to Glasgow could choose the time of high tide for navigating the river ; but, unless the deepening were carried out, the river would be inadequate for the purposes of the canal, which ought to be available at all times of the tide. It could, also, not be anything but detrimental to have all the through traffic between east and west points passing along the Clyde, in addition to the Glasgow traffic. The effect would certainly be to overcrowd the river and render it unsafe.

Most of Mr. Stevenson's criticism was, however, based on the assumption that the projectors of the " Direct Route " proposed the construction of a tidal canal, the cost of which he estimated at £14,000,000, at least ; but Mr. Law Crawford's paper at the International Congress, giving the main points of Messrs. Crouch and Hogg's report and estimate, and constituting the first authoritative statement on the " Direct Route " showed that the canal actually proposed was a high-level one.¹ In the circumstances, therefore, the later criticisms in Mr. Stevenson's " Notes " on Mr. Crawford's paper were much more to the point.

Mr. Crawford's scheme did not, Mr. Stevenson considered, meet the two essential conditions for a Mid-Scotland Ship Canal, namely, that it should be capable of passing the largest class of vessels, including the largest vessels in the Navy, and that it should be as free from locks as practicable, so as to avoid delay and expense in working. He proceeded :—

Mr. Crawford's proposed canal is only 26 ft. deep and can, therefore, only accommodate vessels drawing about 24 ft. of water, the headway is only 75 ft., and the breadth of lock only 60 ft. We propose to make the canal 30 ft. deep, and therefore to accommodate vessels drawing about 28 ft., give a headway of 150 ft., and to make the locks over 80 ft. wide. It would be very unfortunate to make a canal of the

¹ The idea of a sea-level canal by the " Direct Route " had, it would appear, been considered by the Glasgow Provisional Committee, but they did not then think it expedient to entertain any scheme likely to cost more than £7,000,000.

dimensions proposed by Mr. Crawford as vessels are every year increasing in size, and it is indeed too small for the present requirements of the larger ships of her Majesty's Navy or even of the mercantile marine.

Mr. Crawford's scheme involves the passing of vessels through twelve locks, six up and six down, while the scheme we propose has the minimum number of locks possible, consistent with the difference of level that exists between the high and low water levels in the Forth and Clyde—namely, one sea lock at each end. . . .

From calculations I have made, I am satisfied that there is not a large enough drainage area on the direct route to afford the necessary supply of water for the locks and compensate the streams interfered with, even supposing Parliament allowed an embankment to be thrown across every valley and gorge along the route, and permitted the natural water supply for the population of the numerous towns and villages along the route to be appropriated. Many of these valleys are already used for the supply of water to the population of the neighbourhood.

FOUND IMPRACTICABLE.

All the active and persevering efforts made in the interests of the "Direct Route" scheme, as then put forward, failed to secure its adoption. The suggestion that large merchantmen, or ships of the Royal Navy, passing from sea to sea, should first climb up six locks to attain an elevation of 95 ft., and then descend by another six, in order to get back to sea-level again, was regarded as fatal to this particular project, at least. No responsible body, even in Glasgow, would take it up seriously, and the Provisional Committee was shortly afterwards dissolved; though there was to be a revival of the "Direct Route" scheme in another form later on.

FIVE SCHEMES: MR. C. J. WILSON'S PROPOSALS.

Mr. Crawford's book had, nevertheless, done much to awaken public interest in the subject generally. It was well reviewed and it inspired a number of articles in the Press on the national importance of the scheme for a Mid-Scotland ship canal. Public interest had been much stimulated, also, by a further series of letters from Mr. Charles John Wilson published in *The Economist* between November 9th and December 29th, 1889. Mr. Wilson was now able to say that the attention attracted to the subject by his first letters had gone on increasing ever since, and he pointed to the fact that (including the different lines of possible exit from Loch Lomond), there were then five different routes under consideration. He gave a very fair and impartial account of the different proposals, and, during the dates mentioned, kept the readers of *The Economist* informed almost week by week as to the course of events connected with the movement. In his letter of November 9th, 1889, he referred to what was to become the alternative scheme for the "Direct Route"—that, namely, of a sea-level ship canal. Such a canal would, he said, involve a cutting of 115 ft. at the deepest part, in addition to the width of the canal; but it was, he declared—as others were to declare afterwards—"only a question of money," whilst an adequate supply of water, which might be difficult to obtain at the higher level would, he added, be at once assured.

Under date February 26th, 1891, Mr. Wilson published a pamphlet

entitled "Some Particulars of the Suggested Forth and Clyde Ship Canal." Herein he gave a summary of the engineering proposals in respect to the different routes, and added a plea on his own account for the construction of a ship waterway joining the two rivers. He pointed to the commercial and strategical advantages which would be offered by a canal carrying the largest ships, saying, in regard to the use that might be made of it for defensive purposes in time of war :—

It would be of the greatest possible consequence, in such an event, that our fleet should be available for the rapid protection of our shores at any point which an enemy might assail.

We have not spent large sums in fortifications, as many other nations have done, and as, in the game of war last year, it was demonstrated how easily an enemy's fleet could descend upon many points of our shores, it becomes imperatively necessary that our fleet, on which so much depends, should be ready for every emergency.

The Government did not hesitate last year to vote 20 millions, in addition to the usual vote, to be spent on an increase in our ships ; but if by a canal our present ships could be doubled in efficiency for coast defence, it would in this particular be equal to doubling our fleet. May we not, therefore, ask with confidence that the Government should not only appoint a Royal Commission to inquire into the best route, but that, having decided that point, the Treasury might well encourage capitalists to undertake the construction of such a canal by guaranteeing some low rate of interest ?

As a further means of gaining support for the suggestion here made, Mr. Wilson, representing the South of Scotland Chamber of Commerce at the annual meeting of the Associated Chambers of Commerce held in London, March 4th, 1891, proposed a resolution declaring that the establishment of a ship canal connecting the Forth and the Clyde would be of great advantage to commerce between the Continent of Europe and all ports on the west coast of Britain and countries beyond ; that it would, further, at all times be of national value, and that, for these reasons, the Association urged the appointment of a Royal Commission "to inquire into the merits and cost of such an undertaking." In the course of the discussion which followed, Sir Michael Hicks-Beach (President of the Board of Trade) said that if the canal were of national importance the Government should aid it ; but he could see no reason for a Royal Commission if it were proposed that the canal should be made by private enterprise. Thereupon the resolution was carried without any reference to a Royal Commission.

Two days later, in the House of Commons, Mr. Johnston (Belfast) asked the President of the Board of Trade if his attention had been called to Mr. Wilson's proposals ; whether he had seen the report made by Messrs. Crouch and Hogg, and whether the Board of Trade could "give any facilities for testing the practicability of the scheme, its probable cost, the prospects of traffic and the likelihood of its commercial success." To this Sir Michael Hicks-Beach replied :—"I have seen the pamphlet to which the hon. member refers, but I do not know what facilities could be afforded by the Government which are not at the disposal of those who are interested in such a scheme."

CHAPTER XI.

STRATEGICAL QUESTIONS.

DOWN to about the year 1900, the balance between the commercial and the strategical considerations entering into the question of a Mid-Scotland Ship Canal had been fairly well preserved—notwithstanding the tendency on the part of Glasgow interests to dwell upon the former rather than upon the latter, and especially so until the fact became obvious that, apart from the State aid only to be expected if the project were shown to be of national importance, there was little probability of the canal being built at all.

From about 1900, however, strategical began to outweigh commercial advantages, and the former steadily attained a degree of attention which led to their becoming, for some years, the predominant factor in the situation.

GERMAN POLICY.

This development was primarily due to the discussions then arising, and the action taken, on questions of national defence inspired by certain phases of German policy, coupled with a growing consciousness of shortcomings in our own situation.

Various indications had already been given by the Kaiser of an intention on his part that Germany, in addition to being a great Military Power, should also become a great Naval Power.

On June 17th, 1896, he said at a banquet at Cologne, “ Neptune with the trident in his hand is a symbol for us that we have new tasks to fulfil. . . . That trident must be in our fist.” In a telegram to Prince Henry on March 23rd, 1897, he declared :—“ I shall not rest until *I* have raised my fleet to the same level upon which the Army stands.” On October 23rd, 1898, he announced at Stettin that “ Our future lies upon the water.” A week after the outbreak of the Boer War, in October, 1899, he said in a speech at Hamburg, “ We are in bitter need of a strong German fleet ” ; while in the memorandum appended to the German Navy Bill adopted by the Reichstag June 12th, 1900, it was stated :—

To protect Germany's sea trade and colonies in the existing circumstances there is only one means—Germany must have a battle Fleet so strong that even for the adversary with the greatest sea power a war against it would involve such dangers as to imperil his position in the world. For this purpose it is not absolutely necessary that the German battle Fleet should be as strong as that of the greatest Naval

Power, for a great Naval Power will not, as a rule, be in a position to concentrate all its striking forces against us. But even if it should succeed in meeting us with considerable superiority of strength, the defeat of a strong German Fleet would so substantially weaken the enemy that, in spite of the victory he might have obtained, his own position in the world would no longer be secured by an adequate Fleet.

All these things, coupled with successive disturbing phases of German foreign policy in China and elsewhere, led to much consideration as to our own means of self-defence in view of contingencies that seemed to be coming well within the range of possibility ; and among other measures adopted in this country were several which were regarded as bearing on the proposed ship canal between the Forth and the Clyde.

NATIONAL DEFENCES AT HOME.

Following on the recommendations of a special committee appointed in 1902, the Admiralty decided upon the construction of a new naval base and dockyard at Rosyth, on the north bank of the river Forth. This was taken in hand, temporarily suspended, and, in 1905, taken up afresh, the decision having then been arrived at to push on with the works at Rosyth in preference to proceeding with a projected extension of Chatham Dockyard. Rosyth, the House of Commons was informed by the Civil Lord of the Admiralty on July 28th, had been selected because it possessed strategic, economic and industrial advantages over Chatham. It was also accessible at all states of the tide. All the works necessary for a self-contained dock would be put down, and the total cost was estimated at £2,500,000. An official chart issued in March, 1908, showed that the area of land acquired by the Government for the purposes of the naval base and dockyard was 1,184 acres, with 285 acres of foreshore.

The works at Rosyth ; the Dreadnought dock at Renfrew, on the Clyde ; the naval base at Lamlash, on the Isle of Arran (Firth of Clyde), and the reservation of Loch Long for torpedo practice, were all regarded at that time by advocates of a Mid-Scotland Ship Canal as strengthening the case—from the point of view of national interests—in favour of such an undertaking.

Inspired alike by the course of events in connection with Germany's naval and world policy ; by the admitted deficiency of our own national defences, and by the improved conditions being brought about on the Forth and the Clyde, a little group of naval men and others started a fresh propaganda in support of a Mid-Scotland Ship Canal, mainly from the point of view of naval and national advantage, though more specifically, as the Duke of Argyll was to say, later on, because they thought it a matter of importance to have " a back door to the defences of the Clyde and of the Firth of Forth " so that it would be possible to get warships of a reasonable tonnage through quickly from west to east, or *vice versa*. Full recognition was given to the commercial advantages also to be derived from the canal ; but the strategical possibilities of the

waterway were those that mainly inspired this fresh effort to secure the realization of so long-advocated a project.

SIR CHARLES CAMPBELL'S ADVOCACY.

The most active member of the group in question was Vice-Admiral Sir Charles Campbell, K.C.M.G., C.B., D.S.O., who not only took up the scheme with great zeal but practically devoted the remaining years of his life to its advocacy. When he gave evidence before the Royal Commission on Canals and Waterways (April 28th, 1909), he said that for years past he had been "an enthusiast" on the question. "I am," he declared, "saturated with the fact that, on national grounds, the necessity for the construction of the canal is imperative." He changed his views from time to time as to the particular route by which the canal should be taken; but he seemed to regard the question of route as quite a secondary consideration provided only that a canal serving strategical purposes could be secured at all.

On February 13th, 1907, Sir Charles Campbell read at the Royal United Service Institution a paper on "The Strategical Position in the North Sea as strengthened by the Forth and Clyde Battle-ship Canal and the Dover and Sandgate Tube Railway." In the course of this paper he referred to the proposal to build a ship canal through Central Scotland along the route of the existing barge canal; announced that the canal was to be capable of floating the largest merchant steamers and battle-ships, and further declared that—

This waterway would be of enormous benefit to the commerce between Canada and America and Great Britain and Northern Europe, and a most valuable addition to the strength of our strategical position in the North Sea; it would, also, greatly increase the mobility of our battle-ships, cruisers and torpedo craft, and provide means of recuperation to an extent almost impossible elsewhere.

The paramount importance of a safe and speedy means of transport from the Atlantic Ocean to the North Sea, and *vice versa*, other than by the English Channel or Pentland Firth, cannot be too forcibly insisted upon. Such a road would be invaluable in the strategical consideration of our position with reference to other nations whose shores are watered by the so-called German Ocean. To have the power of mustering and sheltering fleets in closed waters, ready at a few hours' notice to operate on either coast or in either sea, would alone be sufficient to justify the expenditure of the capital required.

He recognized the fact that, from a national point of view, "a straight run through" with no more than tidal locks at both ends, would be of great advantage; but he understood that the cost of a sea-level canal had been regarded as prohibitive. There was, on the other hand, the Loch Lomond route scheme; and of this he proceeded to give an account, adding, "For the purposes of my contention to-day, either route would do equally well, so long as we have a rapid transport of our battle force." When, however, his paper was published in Vol. LII. of the "Journal of the Royal United Service Institution," he interpolated, after the statement just quoted, a note as follows:—"December 9, 1907. Now convinced Loch Lomond only route practicable."

A FORTH AND CLYDE NATIONAL ASSOCIATION.

Sir Charles continued his advocacy of the ship canal on the basis of this latest conviction, and he became, in or about March, 1909, the founder of a Forth and Clyde Canal National Association, with headquarters in London ; but, although he gathered around him an influential body of supporters, the Association was, at first, not much more than a one-man affair, such organization work, in the real sense of the term, as was then carried on being done mainly by Sir Charles Campbell himself. He devoted great energy to addressing meetings, to correspondence, to collecting information, and so on. In June, 1909, he visited Glasgow and arranged for the formation of a Glasgow and West of Scotland branch, under the chairmanship of Mr. Arthur Kay, one of the leading merchants of the city, with Mr. Robert Bird as secretary. Over half of the members of the Glasgow Town Council are said to have become members of the branch.

On July 7th, 1909, Sir Charles Campbell read another paper at the Royal United Service Institution, his subject on this occasion being "The Advantages, Strategical and Commercial, of a Battle-ship and Ocean-going-Steamer Canal between the Forth and the Clyde." He spoke of the barge canal between Grangemouth on the Forth and Bowling on the Clyde as having "no strategical importance whatever," and said that two proposals had been made (1) to enlarge the existing canal and (2) to construct a ship canal along the same line of route. In either case there were two very serious objections—the dependence on locks, and the need to deepen the Clyde at a prohibitive original outlay and a gigantic annual expenditure in order to accommodate the traffic passing through the canal exit at Yoker. These objections being, as he considered, insurmountable, he should confine himself, in his paper, to the route via Loch Lomond and Loch Long, which, after very careful study and consultation, he was convinced was "the only possible solution." He gave some details concerning the Loch Lomond route proposals, and went on to say that the strategical value of this national waterway could not be exaggerated either as a means to move a force of battleships, cruisers or torpedo craft from one sea to the other, for the purposes of concentration and attack, or as a means to remove wounded vessels from the "danger zone" so as to dock and repair them in the comparatively safe ports on the Clyde, the Mersey, Barrow, Belfast or in the Clyde itself. It would only be necessary to have an emergency dock, shore or floating, for a ship in a sinking condition. All other wounded vessels could enter the canal and proceed in comparative safety to Stirling, the Clyde or other destination. Commercially there could be no doubt as to the value of such a waterway to the inter-coastal trade of England, Scotland and Ireland. He further regarded the canal, not as an expenditure, but as an investment.

In the scheme proposed by the Forth and Clyde Canal National Association it was, he further said, suggested as an alternative to national

construction that the Government should guarantee payment of 3 per cent. interest on the capital as it was called up. In return for this guarantee the State would have the following advantages :—(1) Free passage to and fro for all Government ships and cargoes ; (2) complete control in time of war ; (3) sinking fund of all profit after 3 per cent. had been paid until advance had been redeemed ; (4) after redemption, the Government still to retain a proportion of the profit for naval construction or other purposes ; and (5) all profit over 3 per cent. to go to reduce the capital outlay, if so desired by the proprietors. With a Government guarantee of 3 per cent. a company could be formed and the work begun at once. Without such guarantee he was convinced that no company would take up the work at all.

Summing up the chief advantages to be derived from the canal, he expressed the opinion that it would (*inter alia*) be of inestimable service in the protection of national trade in the event of war ; enable men-of-war, ocean-going steamers and coasting vessels to obtain coal and oil fuel at the sources of supply, and more than double the mobility of our fleet, giving to it a power of concentration in the Atlantic or on the North Sea which would be denied to our opponents.

COMMITTEE OF IMPERIAL DEFENCE.

Three weeks after the reading of this paper by Sir Charles Campbell, namely, on July 29th, 1909, there was a debate in the House of Commons on Navy and Army Expenditure. One of the main features of the debate was an account given by the Prime Minister, Mr. Asquith, of the work done by the Committee of Imperial Defence—a body whose primary business it was to study and determine the best provision that could be made from time to time for the naval and military requirements of the Empire as a whole, advising the Prime Minister (its President) thereon, but not itself possessing any executive power. During the preceding three years, Mr. Asquith told the House, this committee had appointed sub-committees to carry out exhaustive inquiries into various questions, reporting thereon to the committee ; and among the questions he mentioned as having been thus investigated he included (without going into further details), “ The strategical aspects—a small but important matter—of the Forth and Clyde Canal.”

Later on in the debate, Mr. Arthur Hamilton Lee (now Lord Lee of Fareham) inquired what conclusion had been arrived at, and the Secretary of State for War, Mr. (afterwards Lord) Haldane, in replying for the Government, said :—“ The hon. gentleman asked a question about the Forth and Clyde Canal and what conclusion we had come to in regard to it. The expenditure necessary *to make this canal of any use* would be enormously out of proportion to the value to be got from it. That is the conclusion come to by the most distinguished Admiralty experts who have investigated the matter.”

Mr. Lee then further inquired whether the conclusion was come to solely on financial grounds, assuming that *the cost of constructing the*

canal might be borne by the commercial interests, or was come to from a strategical standpoint.

Mr. Haldane answered :—" There was no prospect of those commercially interested paying more than would provide for its upkeep. The conclusion was clear, when the Admiralty experts came to inspect the matter, that the money would be enormously better spent in other directions."

All this is very puzzling, since one cannot say to what "Forth and Clyde Canal" it was that either of the speakers referred—the present barge canal, or the proposed new ship canal by one or other of the alternate routes. Mr. Asquith himself was distinctly vague. The words put in italics in the War Secretary's statement, quoted above, namely, "to make this canal of any use," appear to suggest that he alluded to an existing, that is to say, to the barge canal. If so, there is no occasion for dissenting from the decision he announced. On the other hand, the reference by Mr. Lee to "the cost of constructing the canal" seems to imply that what he had in his mind was a ship canal which would require to be built, though even then he did not allude to the question of route.

The position taken up by the Admiralty and the Committee of Imperial Defence was, indeed, not made clear until the issue by the Royal Commission on Canals and Waterways of their Final Report, in which, as will be shown in the following Chapter, there were announced certain conclusions materially affecting the whole situation.

CHAPTER XII.

ROYAL COMMISSION ON CANALS AND WATERWAYS.

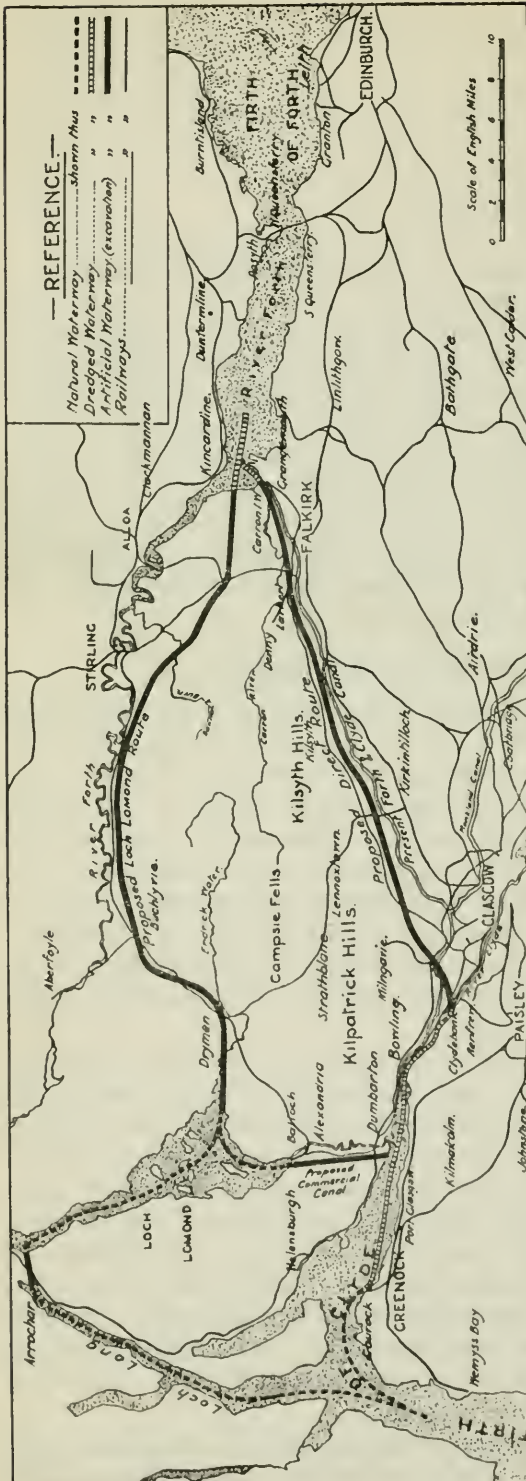
WHILST Admiral Sir Charles Campbell was so actively employed in seeking to arouse public opinion as to the importance of a Mid-Scotland Ship Canal from the point of view of national defence, the Government had, on March 5th, 1906, appointed a Royal Commission, under the chairmanship of Lord Shuttleworth, to inquire into the whole subject of the canals and inland waterways of the United Kingdom ; and the members of this Commission not only took a good deal of evidence in regard to the various proposals relating to communications between the Forth and the Clyde but had their attention directed in an especial degree to the strategical considerations involved.

LOCH LOMOND SCHEME ADVOCATES.

Mr. David Alan Stevenson attended the sittings of the Commission on two occasions. On July 16th, 1907, he gave an account of the main features of the Loch Lomond scheme, as detailed in Chapter X, and explained his reasons for preferring that route to the other. He further suggested that, if the Admiralty and the Government should consider that the making of a canal by the Loch Lomond route would be of advantage to the country—as he himself thought it undoubtedly would be—the State should guarantee a small return on the outlay of £17,000,000. The money, he said, could be raised with a Government guarantee, but not without. The Loch Lomond route was the one which would be of real value to ships of war.

In order to meet certain criticisms raised by some of the Commissioners, and, also, to meet what were understood to be the views of the Admiralty, Messrs. Stevenson undertook fresh surveys and prepared fresh plans and estimates, the main features of which were explained by Mr. D. A. Stevenson to the Royal Commission on April 28th, 1909. His firm now proposed to leave what they regarded as “the tempting low-lying land” of the Forth Valley between Alloa and Stirling ; to construct the entrance locks on the east at a point four and a half miles below Alloa and one and a half miles above Grangemouth ; to strike inland at once, passing to the south instead of to the north of Stirling, and join the low ground again on the other side of Stirling. From this point the route would continue as before.

The proposed deviation would overcome certain engineering difficulties, and there would no longer be any railway swing bridges on the



THE ALTERNATIVE ROUTES FOR THE PROPOSED FORTH AND CLYDE SHIP CANAL.

route, the three rail-ways to be crossed, and, also, most of the roads, being carried over the canal by fixed bridges having a headway of 120 ft. This arrangement would give clear passage to all vessels without any need for striking or shortening their masts.

The distance from the Forth, just above Rosyth, to the Cloch Light-house in the Firth of Clyde, would be fifty-one nautical miles, namely, thirty miles of dredged channel or canal, and twenty-one miles of open water in Loch Lomond and Loch Long. The deepest cuttings were to be 191 ft. at a point just to the south of Stirling, 285 ft. at the head of the Forth Valley, and 142 ft. between Tarbet and Arrochar. The average depth of cutting would be about 101 ft. As in the earlier scheme, a bottom width of 100 ft. was allowed for, with slopes varying with the nature of the material and passing places every five miles; but provision was now made for a depth of 36 ft., in place of 31 ft., in order to accommodate vessels of the largest draught and

even damaged battleships drawing more than their normal draught. The locks would have dimensions as already stated, with 36 ft. of water on the cills.

The estimate for an undertaking of the dimensions here stated—which dimensions were considered by Messrs. Stevenson to be sufficient to accommodate the largest vessels of his Majesty's Navy—was £20,012,000; but if a purely commercial canal, 70 ft. wide at the bottom and 31 ft. deep, would suffice, this could be provided for about £12,000,000.

Sir John Jackson gave evidence (April 27th, 1909), in support of the Loch Lomond route, and disclosed the interesting fact that he himself had paid for one of the surveys made by Messrs. Stevenson, and that the cost of the last survey—presumably the one leading to the modifications detailed by Mr. D. A. Stevenson on the second occasion of his appearing before the Commission—were divided between the Duke of Sutherland, Lord Strathcona and himself. The money, Sir John further said, had been mostly spent on the Loch Lomond route, although the other route had been studied. By the latter the canal traffic would debouch into the Clyde in a way that would seriously interfere with the existing traffic between Glasgow and the mouth of the Clyde.

On the financial aspects of the scheme, Sir John Jackson said one could not reasonably hope that a sufficient net revenue would be got from commercial sources to enable a company constructing the canal to pay the 5 or 6 per cent. that investors would naturally expect before they put their money into the enterprise. His idea was that, after the canal had been opened a few years, it would have a net revenue sufficient to pay 2 or 3 per cent., and that the Government should give a guarantee of 3 per cent. on the capital raised, thus bringing the prospective dividend up to the figure mentioned, and enabling the company to get the money they would want. "I do not think," he added, "that there is any prospect of the canal being constructed unless there is a Government guarantee in some shape. You cannot, in my opinion, fairly ask the public to subscribe to a scheme of this kind unless you can estimate a return of, at any rate, 5 or 6 per cent. upon the capital; and, candidly, I do not think it would be reasonable to assume a return of that kind in this case."

Admiral Sir Charles Campbell (April 28th, 1909), advocated a canal designed more especially to serve strategical purposes and taken, preferably, by the Loch Lomond route. In the first place, he thought that "to be able to get from one sea to another by a short route which would be denied to our opponents would be a valuable strategical move in any naval operation which we might have on hand." In the next place, he suggested that a great saving might be made in the works then proceeding at Rosyth if this canal were formed and the western dockyards made available for the east coast fleet or for other vessels damaged in an action on the east coast. There would be an emergency dock at Rosyth for a wounded ship which could not float, but everything that could float, and drawing not more than 36 ft. of water, would go into the canal and

get to what might be called the lee side of Scotland, away from all danger. He went on to say:—

I have long been of opinion that the south of Ireland route is an absolutely impossible route for boats in time of war. It would take ten or fifteen times the number of cruisers to defend it that the North of Ireland route would take. Therefore I believe that all food for the east coast or for the country generally should go the north of Ireland route, go through the canal, and be distributed on the east coast ports, or by other means if the blockade was severe. Supposing a North Sea nation were fighting against us, it might be severe; but, as a rule, you would be able to send them along very much better than you could in any other way. I think that is one of the strategical advantages of the canal—the facilitation of the distribution of food-stuffs, and the smaller number of cruisers that would be required to protect the route. I think the canal would be of great advantage to ships coming from the Atlantic, and that you would get your food-stuffs to Newcastle, Leeds and many other places in the quickest possible time, in the cheapest manner, and with the least disturbance.

In regard to the commercial advantages of a ship canal across Central Scotland, he handed in a map showing the saving in distance that would be effected on the different routes from Northern and Baltic ports to Canada and America. As for the route to be chosen for the proposed canal, he had “come to the absolute conclusion” that the one which should be chosen was the Loch Lomond route. He was in favour of the “Direct Route” on certain points. It passed through an industrial district and would be more likely to get commercial traffic; but it would be impossible for large men-of-war and vessels of the *Lusitania* class to use a canal having all those locks. Another very strong reason against the “Direct Route” was the congestion of the Clyde below Yoker. Much dredging of the Clyde, also, would be necessary. Vessels would be able to go at full speed in Loch Lomond, and it was his “definite opinion” that there would be no saving of time by the “Direct Route.” On the financial aspects of the question, he was strongly in favour of the view that the Government should build the canal, or, at least, should guarantee 3 per cent. on the capital. Failing that, the canal could not be made. No one, otherwise, would be likely to put his money into it.

SUPPORTERS OF THE “DIRECT ROUTE.”

The case for the “Direct Route” was presented (July 9th, 1907) by Mr. C. P. Hogg, M.Inst.C.E. (Messrs. Crouch and Hogg, Glasgow). The canal he recommended was practically identical with the one for which his firm had carried out surveys and prepared plans for the Glasgow Provisional Committee in 1890–91. That is to say, it was to be a canal 26 ft. deep, with a summit level of 95 ft. above mean sea level, was to have twelve locks, and would cost £7,000,000. The canal would cross six railways, and in two instances swing bridges would be necessary. In reply to a question put to him, Mr. Hogg said a deepening of the cut to 40 ft., if needed to suit Admiralty requirements, was quite possible; but the cost would be prohibitive except for the Government. A great

deepening of the Clyde would also be necessary in order that advantage could be taken of a 40-ft. canal.

In a written statement, added to his evidence as an appendix, Mr. Hogg further said in regard to the "Direct Route" scheme:—

One of the most essential points to be considered in selecting a line for the proposed canal is that the summit level should be as low as is consistent with keeping the amount of excavation within reasonable limits. In our opinion, the cost of making a cut free from locks or other methods of raising vessels would be quite prohibitory, and, therefore, at a very early stage of our investigation we abandoned any idea of the kind. The summit level we have considered it best to adopt is 95 ft. above Ordnance datum.

Subsequently, the advocates of the "Direct Route" were to bring forward alternative proposals for a sea-level canal; but the fact should be borne in mind that the only "Direct Route" schemes which the members of the Royal Commission had definitely before them applied to a high-level canal, and it was upon these that their decision in regard to that route was afterwards based.

The "Direct Route" advocates may, indeed, be considered to have been at a disadvantage in not having their revised plans ready to lay before the Royal Commission, as was done by Messrs. Stevenson in the case of the Loch Lomond route.

Mr. Bruce Murray, a Glasgow shipowner, and Mr. Alan M'Lymont Ure, a Glasgow ironfounder, as representing the Glasgow Corporation, both attended before the Commission and gave evidence in support of the "Direct Route." The former said that, as regarded the mercantile marine, a passage between the Clyde and the Forth, as an alternative to the English Channel, would be of immense value in time of war, as it would admit of the movement of British tonnage in a manner that might not be possible were we dependent on the English Channel alone. For both naval and merchant vessels, the facilities for repair, bunkering, docking, etc., presented by what would virtually be one great inland system of docks were obvious, while, from the point of view of national defence, a great inland arsenal could be formed unequalled in the world. A very deep cutting could be made, with only one lock at each end. It was only a question of money.

Rightly or wrongly, the witness continued, the feeling in Glasgow was that it was not the Government who were proposing to construct the canal, and that, unless the Government took the project in hand, the scheme would not come within the range of practical politics. He went on to show that Glasgow's interests were greatly concerned in the matter. The route and the debouchments of the canal were of great importance—"especially to Glasgow." If the "Direct Route" scheme were adopted, the canal would debouch practically in Glasgow harbour, Yoker being inside the most recent docks constructed by the Clyde Trust. This would bring the canal traffic quite into Glasgow. As a practical shipowner, he attached no importance to any suggestion that the Clyde would be overcrowded—assuming that the river was deepened,

as it would have to be, in the interests of Glasgow, apart altogether from that special scheme.

Asked what were his objections to the route via Loch Lomond, Mr. Murray said that route did not remove the drawbacks under which Glasgow suffered in being at the end of a long *cul-de-sac*. Vessels coming through the canal by the Loch Lomond route and desiring to trade with Glasgow or to collect traffic would have a long journey up the Clyde and down again, with consequent delay and expense, the length of the journey from Greenock to Glasgow being about twenty miles.

Apart from the intervention of the State, the witness did not think there was any likelihood of the enterprise being taken up as a purely commercial speculation—at any rate not in the near future. There was no prospect for a ship canal unless the State decided that such a canal was advisable in the interests of national security.

Attempts were made to elicit from Mr. Murray—as a member both of the Glasgow Town Council and of the Glasgow Chamber of Commerce—some idea as to the extent to which financial support might be expected to come from Glasgow in the event of the Royal Commission adopting a view favourable to the construction of a ship canal. “Supposing,” he was asked, “Glasgow said ‘For commercial reasons we must have the direct route’; and supposing the Government said, ‘For certain other reasons we must have the Loch Lomond route’; would the scheme be likely to be taken up by Glasgow?” “I should think,” replied Mr. Murray, “the city of Glasgow would hesitate before incurring any responsibility.”

The Chairman of the Commission called Mr. Murray’s attention to the fact that letters to the following effect in regard to the ship canal scheme had been addressed to the Town Clerks of various places in Scotland, including Glasgow:—

I am directed to inform you that it will probably have considerable weight with this Commission if any prospect could be held out to it that a local contribution would be forthcoming on its construction. I should be glad, therefore, if you would consult your Corporation on the matter, and if any evidence bearing upon this could be placed before the Commission when they are taking evidence on the subject.

Mr. Murray answered that the matter was discussed at a meeting of the Finance Committee of Glasgow, but was regarded as being too indefinite to admit of the Corporation holding out any promise. “The Commission,” he remarked, “asked what contribution the Corporation would give to a canal, but did not say *what* canal, and the Corporation had nothing before them to found a statement upon.”

To this the Chairman rejoined:—“We are not very likely to make a pronouncement unless we have help from Scotland, and we have had extremely little help from Scotland.”

Mr. Ure told the Commission it was generally admitted that the naval base at Rosyth would not be complete until a strategical canal was made between east and west, though he held the view that, when a strategical canal was decided on, commercial considerations should

certainly be studied as well. He preferred the "Direct Route" because it would go through a mineral and industrial district, and, from a commercial point of view, a "Direct Route" canal would be a paying concern. There were many large iron works and other important undertakings in the district, and, if a ship canal were provided, these enterprises would prefer to put their products on board ship at once instead of sending them by rail to Glasgow or Grangemouth for transshipment. In the same way they would receive their raw materials direct from ship. The witness further passed some criticisms on the present barge canal. Thereupon Sir John Wilson, one of the Commissioners, asked him, "Are you aware that the Commissioners visited the canal and found that the traffic there had decreased considerably within the last twenty years, and that they had evidence that the Caledonian Railway Company were anxious to get traffic on the canal because they were subtracting it from the North British Railway Company, their rivals? Are you aware that the Forth and Clyde canal is the finest canal in the kingdom, with the exception, perhaps, of the Aire and Calder, and that is nearly 10 ft. deep?"

Provost Archibald Christie, of Falkirk, also favoured the "Direct Route." A ship canal by this route would go through the centre of the Scottish iron industry and would be in direct touch with the Scottish mineral fields. It would afford unlimited scope for quays along its banks. "There is no reason," he declared, "why the whole waterway between Yoker and Grangemouth should not be practically one elongated line of wharves." This witness, also, was inclined to criticize the Forth and Clyde Navigation, and thereupon the Chairman of the Commission asked him, "Are you aware that already you have a canal of better dimensions than any canal in England except the Manchester Ship Canal and the Weaver Navigation, with, possibly, the exception of parts of the Aire and Calder Navigation, also?"

Another witness, Mr. W. T. Douglass, M.Inst.C.E., consulting engineer to the Public Works Loan Commissioners for harbours, said that in 1903 he was asked to inquire into three schemes put before him for a ship canal between the Forth and Clyde—(1) a canal from near Alloa in the Firth of Forth through Stirling to Loch Lomond, and entering the Clyde at Dumbarton; (2) a sea-level canal between Grangemouth, in the Firth of Forth, and Yoker, on the Clyde; and (3) a high-level canal, with locks, between Grangemouth and Yoker. He made a survey on his own account, and he reported in January, 1904, in favour of (3), which he considered the most suitable. His route and that proposed by Messrs. Crouch and Hogg were practically the same, though the levels varied considerably and there were deviations in the actual line.¹ Asked if he had considered the question of a sea-level canal, with only one lock at each end,

¹ Mr. Douglass had previously given some details of his scheme at the Royal United Service Institute meeting referred to on p. 195. He then stated that the canal he proposed would have a bottom width of about 130 ft. and a depth of 30 ft. An entrance lock at Grangemouth, with six other locks to follow, would raise vessels to a summit level of 110 ft. They would continue on this for a distance of 18 miles, and then descend to the level of the Clyde at Yoker by a further series of six locks. He estimated the total cost at £10,000,000.

he replied :—" When the matter was before me in 1903, I looked into the question of a sea-level canal, and I found that the excavation would run to about 235,000,000 cubic yards, which would be more than three times the amount of the lock canal. The cost would be so high that it would be impossible to get the work through." He did not think the scheme should be carried out as a purely commercial speculation. Commercially alone, it would not pay. It should be a national project, or, at least, have a national aim. It would be useful to the nation for strategical purposes ; but if the country wished for the canal it was the country that should pay for it.

Then, also, Mr. Millar, General Manager of the Caledonian Railway Company, whose views as to the impossibility of deepening the Forth and Clyde barge canal have been recorded on p. 140, said he had grave doubts whether a deep-water ship canal would prove a successful undertaking. It would require to follow, in great measure, the course of the existing canal, and it was doubtful whether a sufficient supply of water would be got for an undertaking of the kind proposed. " In very dry seasons," he said, " our supply, while it has been sufficient, has been nearly exhausted on more than one occasion. A good deal of the water collected by us for the use of the canal is lost through leakage caused by underground workings in the district along which the water is conveyed from the reservoirs to the canal."

VIEWES OF THE COMMITTEE OF IMPERIAL DEFENCE.

In regard to strategical considerations as affecting a Mid-Scotland Ship Canal, the Final Report of the Royal Commission (issued under date December 4th, 1909), showed that in December, 1908, the First Lord of the Admiralty expressed to the Chairman of the Commission his hope " that evidence may be taken in order that questions of initial cost, and how far and in what conditions as to depth, width and number of locks the canal may be made self-supporting from a commercial standpoint, may be investigated." The First Lord also undertook that a statement as to the strategical advantages of the canal in certain conceivable circumstances should be sent to the Commission.

In January, 1909, the Chairman was informed by the secretary of the Committee of Imperial Defence that consideration by that Committee of the question of the strategical importance of a canal connecting the Forth and the Clyde was probable. The Chairman replied that the Commission would welcome the considered opinion of the Committee of Imperial Defence. He added :—

The Commission have no idea of investigating for themselves the question of the degree of strategical importance to be attributed to this scheme. But, in reporting on it as a commercial canal, they need authoritative guidance on its strategical aspect from his Majesty's Government, or from the Committee of Imperial Defence. Information as to the views and policy of his Majesty's Government on the project of a ship canal suitable for use by ships of war appears to be necessary if the Commission are to make an effective report, for there seems to be no reason to hope that such a canal would be constructed without State assistance.

All the evidence and information received by the Royal Commission on strategical aspects of the question was communicated to the Committee of Imperial Defence, as well as to the Admiralty. When, also, the sub-committee of the Committee of Imperial Defence made their inquiry, Mr. David Alan Stevenson was invited to attend and explain the details of the scheme prepared by his firm in regard to the Loch Lomond route.

The conclusions arrived at by the Committee of Imperial Defence were, by direction of the Prime Minister, communicated to the Chairman of the Royal Commission in June, 1909, the First Lord of the Admiralty intimating, at the same time, that they were to be regarded as embodying, also, the views of the Admiralty. The conclusions are thus summarized in the report of the Royal Commission :—

(1) A ship canal connecting the Forth and Clyde, and constructed to meet the requirements of the Admiralty, would unquestionably possess some strategical value.

(2) This value alone would not be sufficient, however, to warrant any considerable expenditure from Government funds, or such a liability as a guarantee of interest on the total cost of construction as estimated.

(3) Should there be a prospect of a canal being constructed for commercial purposes, it would then be worth while to offer some Government aid in order to secure the conditions laid down by the Admiralty as necessary for the passage of battleships.

(4) **The route through Loch Lomond and Loch Long is the only one which satisfies naval requirements.**

The minimum dimensions required by the Admiralty were stated to be as follows :—Depth of canal, 36 ft. ; width on floor of canal, 148 ft. Locks : length, 850 ft. ; width of entrance, 110 ft. ; depth of canal lock, 36 ft. These figures would give a canal of the depth finally proposed by Sir John Jackson and Messrs. Stevenson, but of considerably greater width at the bottom—namely, 148 ft. instead of 100 ft.—and having wider locks.

RECOMMENDATION OF THE ROYAL COMMISSION.

Commenting on the above conclusions of the Committee of Imperial Defence, the Final Report of the Royal Commission said :—

Under these circumstances, the only recommendation which the Commission are able to make is that the Scottish and shipping interests which would be commercially benefitted by such a ship canal should consider, with the promoters of the Loch Lomond scheme, whether funds could be raised for carrying the project into effect, and that, if there should prove to be any prospect of sufficient capital being forthcoming, with such aid as his Majesty's Government may be prepared to offer, the probable amount of such Government aid should be ascertained with a view to carrying the scheme into effect.

CHAPTER XIII.

INTERESTS OF GLASGOW.

ON the formation, in June, 1909, of a Glasgow and West of Scotland branch of that Forth and Clyde Canal National Association which Admiral Sir Charles Campbell had started in London, an active propaganda was begun with a view to inducing merchants and other leading men in Glasgow and its surroundings to join the movement.

As will have been gathered from the reference (p. 196) made to the paper read by him at the Royal United Service Institution on July 7th, 1909, Sir Charles was, at this time, still a supporter of the Loch Lomond route. In the course of a few months, however, those concerned in the working of the Glasgow branch came into touch with the party which had remained faithful to Mr. J. Law Crawford's "Direct Route" scheme. The interests of Glasgow were regarded as being closely concerned therein, and the fact became manifest that it would be hopeless to expect support from that city for the Loch Lomond and Loch Long scheme, under which vessels using the canal would, instead of emerging near to Glasgow, be brought no nearer thereto by the line of route than the mouth of the Clyde. Such a result would, it was declared, be "the ruin of Glasgow."

The tendency of Glasgow opinion was indicated by a resolution which, on the motion of Mr. Alexander Ure, the Corporation adopted, by twenty-eight votes against eighteen, at a meeting of that body held on October 22nd, 1908. This resolution was to the following effect:—

That, looking to the large amount of unemployment prevailing at the present time and to the desirability of the Government as far as possible providing suitable work, the Corporation memorialise the Government to consider the proposal to construct a ship canal between the Forth and Clyde which would be a means of providing useful serviceable work for skilled and unskilled labour, and would secure a *direct navigable channel* between the North Sea and the Atlantic which would be advantageous both *for the city* and for the commerce of the country.

Still more clearly was the same tendency shown by the evidence given before the Royal Commission by the deputed representatives of the Glasgow Corporation. This evidence implied, in effect, that the Corporation would make no promise of support until they knew which route would be adopted, and that no support at all was to be expected from Glasgow if the route selected should be the one by way of Loch Lomond.

Nor, when the Royal Commission, in its Final Report, recommended that the Scottish and shipping interests should combine with the promoters

of the Loch Lomond scheme—regarded by the Committee of Imperial Defence as the only one satisfying naval requirements—was there any disposition on the part of Glasgow so to do.

THE PROPOSED SEA-LEVEL “ DIRECT ROUTE ” CANAL.

The “ Direct Route ” scheme thus virtually rejected by the Royal Commission was that which would have required all vessels using the canal to ascend one set of locks and descend by another in order to overcome an elevation of 95 ft. above Ordnance datum ; and the fact had to be recognized that such an arrangement as this would really have been quite impracticable, from a strategical point of view at least.

The Glasgow interests, however, now brought forward an alternative plan. Further investigation had convinced them that, apart from the question of locks, there would be much difficulty in obtaining and maintaining a sufficiency of water for a high-level ship canal, and they began to consider the possibility of drawing a water supply from the sea. In the result, while still adhering to the “ Direct Route,” they proposed that the canal to be constructed should, preferably, be a sea-level canal with only two locks—one at each end to overcome the tidal differences in the Forth and the Clyde respectively.

There was, of course, nothing really new in this proposal. The evidence given before the Royal Commission alike by Mr. C. P. Hogg, Mr. Bruce Murray and Mr. W. T. Douglass showed that a sea-level canal had already been suggested, but had hitherto been regarded as impossible of attainment because the cost would be prohibitive. The engineers consulted now gave it as their opinion that, so far as construction was concerned, a sea-level sea-water canal by the “ Direct Route ” was perfectly practicable, notwithstanding the depth of the cutting that would require to be done, and that the whole question resolved itself into one of money. On only one point did the engineers fail to agree, and that was as to the exact difference in cost between a high-level and a sea-level canal.

Having regard to the situation thus brought about, the prospect of securing support at Glasgow for a Loch Lomond route canal seemed to become more hopeless than ever. This view was very emphatically put before Sir Charles in a letter addressed to him in the autumn of 1910 by Mr. Arthur Kay, and quoted by Mr. Robert Bird in an article on “ The Mid-Scotland Ship Canal ” contributed by him to *The National Review* for January, 1913. The passages given from the letter are as follows :—

The feeling of a city like Glasgow cannot be gauged by meetings. It must be gradually measured by studying the views of the leading commercial men, and it is pretty clear that the Loch Lomond route will receive no moral support, much less material support, if, as people believe, the Direct Route is practicable. This must be faced, fought, disproved or admitted. The engineer of Glasgow Corporation looks favourably upon the Direct Route and the men with practical knowledge of the Clyde are convinced that the channel presents no insuperable difficulties. The Admiralty seemed to condemn the Direct Route because it was presented to them with twelve

locks. What would their view have been of a *direct sea-level canal with only one sea lock at each end*?

Sir Charles Campbell would appear to have been eventually re-converted to the "Direct Route" which he had originally favoured, Mr. Bird further saying, on the basis of his official knowledge:—"When it was demonstrated to him that the Direct Route at *sea-level* was possible, he accepted the changed conditions. At the same time his main idea was 'Give me a ship canal by any route you please, so that you give me a canal and give it me soon.'"

The gallant Admiral was, however, unable to continue very much longer his advocacy of a project to which he had applied himself with such patriotic zeal and energy, his death occurring February 7th, 1911.

In the spring of the same year a conference of the engineers and others concerned in the two routes was held in Glasgow with a view to seeing if some agreement could not be arrived at between them, so that for the future their combined forces might be directed to promoting one and the same scheme. At this conference a series of questions was gone through, and a resolution was passed declaring that a ship canal by the "Direct Route" presented no insuperable difficulties; that its commercial advantages would be greater, and that this was the route which should be recommended for adoption. The resolution was confirmed by the Glasgow branch and, on May 11th, 1911, was submitted to a special meeting of the parent Association held at the Royal United Service Institution, London, under the chairmanship of the late Duke of Sutherland, President. A further resolution then passed stated that—

Considering it is essential to the project of a ship canal from the Forth to the Clyde that the promoters should unite upon one route, and having heard explanations, this meeting agrees to promote the Direct Route at sea level from Grangemouth to Yoker, and that the commercial and strategic advantages of this route be pressed upon his Majesty's Government.

Meanwhile Mr. David Alan Stevenson had read before the Royal Scottish Society of Arts, on January 31st, 1910, a paper on "The Proposed Forth and Clyde Ship Canal" in which he discussed the respective merits of the two routes and said that his firm, having regard to what they considered the disadvantages of the route via Yoker—where, he pointed out, vessels proceeding through the canal would still be sixteen miles from deep water—turned their attention to the Forth Valley; "and here," he continued, "they found just what was wanted." This paper was published by the Royal Scottish Society of Arts in Vol. XVIII, Part IV (1914) of its *Transactions*, and it was then reprinted in pamphlet form by Mr. Stevenson, who added the following statement:—

The foregoing Paper was read on 31st January, 1910, but the Society before whom it was read have only been able to publish it now.

Since it was written there has been a considerable renewal of interest in the canal scheme, and certain Glasgow gentlemen have now realised what an advantage to trade a canal would be. They perhaps naturally would prefer that the canal should take the shorter route and pass close to Glasgow, joining the Clyde at Yoker.

At a meeting held in Glasgow, the author's firm was asked in conjunction with Mr. Hogg, M.Inst.C.E., to further develop and work out a definite scheme on this Yoker route, in the same detail as my firm had already done for the Loch Lomond route ; and to enable us to do so, it was resolved by the meeting to raise funds for the purpose of making the survey and taking borings. These necessary funds have, however, not yet been raised.

Nor were the said funds ever raised at all, and in a copy of Mr. Stevenson's pamphlet in the possession of the present writer there is pasted on the concluding page a type-written statement as follows :—

P.S.—On the advice of those advocating the Loch Lomond route we have severed our connection with the promoters of the Yoker or Clydebank route as the latter are determined apparently to push that route whether it is the best route or not, and of course our opinion, having studied all the routes, is that the Loch Lomond is the only feasible route and the best in the interests of Glasgow itself.

September, 1917.

Revised estimates in 1913 put the cost of a " Direct Route " sea-level canal at £24,000,000, and it was then said that the money would be forthcoming from the public if, only, the State would guarantee three per cent. interest on the capital outlay, taking in return the surplus canal revenues.

AN APPEAL TO THE DEVELOPMENT COMMISSIONERS.

While, however, statements as to the practicability of a sea-level canal were being made on the authority of engineers who had been consulted, it was thought desirable that a survey of the route should be made and an estimate of the cost based on definite data prepared, in order to " demonstrate the feasibility and reasonableness " of the proposal. The expense of such a survey would not, it was said, exceed £3,000. In order to raise this amount, the Glasgow branch, in May, 1913, made an application through the Treasury for a grant from the funds at the disposal of the Development Commissioners for the development of the roads and waterways of the country, including canals. The Treasury was informed that the Association had been " endeavouring to collect funds " for the purpose stated, that they " expected the localities interested would contribute," and that they proposed the Government should recommend a grant out of the Development Fund, any grant so made to be administered by the executive of the Glasgow and West of Scotland branch.

The application was said to be supported by more than thirty Town Councils, Harbour Boards and other public bodies in Scotland and England ; and it is by no means clear why, in these circumstances, it should have been necessary to petition the Government to grant so comparatively small a sum as £3,000 for the purposes of a survey. One would have thought that Glasgow alone should have been able to raise the amount in twenty-four hours if it were really the case that her " ruin " was likely to be brought about by the adoption of the Loch Lomond route.

Whatever the view to be taken of the situation as here stated, no reply was made to the application until two years and eight months had

elapsed from the time it was made. The Canal Association (which, in December, 1914, had pointed out to the Development Commissioners how important a part the proposed ship canal, had it been brought into existence, might have played in the war) was then informed by the Treasury that the Development Commissioners were unable to recommend an advance for the purpose asked. The Association thereupon begged to be favoured with a copy of the Commissioners' report ; but the Treasury replied that they could not comply with the request, adding :—

In any case the financial situation would preclude my Lords from entertaining the application at the present time, and, should funds be available at a later date, it would be a question whether action should not be taken by his Majesty's Government, if necessary, rather than by a private association.

In the Fifth Annual Report of the Development Commissioners, issued in January, 1916, it was further stated that—

An application for a grant for a preliminary survey in connexion with the proposed Forth to Clyde Ship Canal was refused. The Departments concerned considered that the survey should be deferred during the war, and that the investigation should be retained by the Government in their own hand.

GLASGOW'S INTERESTS AND GLASGOW'S DANGER.

In February, 1917, Mr. Robert Bird, secretary of what was now known as the " Mid-Scotland Ship Canal National Association for Glasgow and the West of Scotland," contributed a further article to *The National Review* on a " Mid-Scotland Ship Canal at Sea-Level," relating, among other things, what had happened in regard to the desired grant by the Development Commissioners. He made a strong plea for the proposed " Direct Route " sea-level canal, describing its main features, pointing to the various advantages—strategical and commercial—to be derived from the undertaking, and urging that, as a national project, it should receive national support.

Early in the same year (1917) the fact became known in Glasgow that Messrs. Sir W. G. Armstrong, Whitworth and Co., Ltd., as civil engineers and contractors for public works, had prepared a report on a project for a ship canal between the Forth and Clyde, via Loch Lomond. Thereupon the Glasgow Association sent out a circular inviting support for the " Direct Route " sea-level canal which, it stated, was already " backed by the Corporation of Glasgow and many influential gentlemen." Headed :—

" GLASGOW'S DANGER ! "

the circular announced :—" Plans are now ready for a ship canal sixty miles long via Loch Lomond and Loch Long, with locks at each end of Loch Lomond, and that route will be taken if Glasgow does not secure the Direct Route at Sea Level, twenty-nine miles long." ¹ The canal was to be 40 ft. deep, 148 ft. wide, and was to have one sea gate at each

¹ The latter figures, it will be noticed, do not allow for the deepening of the Clyde, for the purposes of the canal, if the Direct Route were adopted.

end—that at the Forth end to be open at high water and spring tides. “A well-known contractor,” it was said, had offered to make the canal in five years if the Government would guarantee interest on the cost, the pre-war estimate of which was £24,000,000. The “Advantages” of the canal were thus detailed:—

Connect two seas by a safe salt-water channel along the richest mineral valley in Scotland.

Save 434 miles from Dundee, 449 from Newcastle, and 271 from London to Glasgow.

Best route from North Europe and Baltic to west coast, America and Canada, and from port to port of Great Britain.

A back-door to Rosyth, doubling the local mobility of the Navy.

Make Clyde the greatest arsenal, and Glasgow the greatest distributing centre.

Add to the commerce and safety of the country, and give employment to thousands of men.

The issue of this circular was followed, in the middle of May, 1917, by the forwarding of the following “Open Letter” from the Association to the Glasgow Corporation, the Clyde Trust and the Glasgow Chamber of Commerce:—

We beg to invite your attention to the critical position which the construction of a Mid-Scotland Ship Canal at sea-level has suddenly assumed, and in which the prosperity of Glasgow, the Clyde, and the West of Scotland are vitally concerned.

You have no doubt observed from the question put in Parliament on roth inst. that the Admiralty have been recently considering the uses that would have been made of a canal if it had been in existence during the War, and that they are at present considering what steps should be taken to decide between the Loch Lomond Route, 22 ft. above sea-level, and the Direct Route at sea-level, and to form an estimate of the cost of construction by the Government, of such a national waterway for strategic and commercial purposes.

This answer accords with information which has been in our possession for some time. Plans and estimates, complete in every detail, of the Loch Lomond Route, have been in the hands of the Admiralty, and have been looked upon with favour as an undertaking at the conclusion of War. It has been the common opinion of Glasgow and the West of Scotland for many years that any such Canal must be by the Direct Route, otherwise a great opportunity would be lost, and serious injury would result to Scotland and the North of England.

A Mid-Scotland Ship Canal has been practically decided upon, and we would urge upon you to take the matter up at once, and by Direct Route plans, petitions and deputations to the Government, make a clear demand that the Canal must be along the Direct Route, and not by Loch Lomond.

We would also suggest that Glasgow Corporation, Glasgow Chamber of Commerce, and the Clyde Trust should co-operate in this matter, and if we can give you any information or assist you in any way within our power we shall be glad to do it.

The propagandist work of the Association now became especially active. The “Direct Route” scheme itself underwent a further development, there being issued, later on in the year 1917, some illustrated “suggestions” for a basin and shipping docks which, it was proposed, should be constructed on the ship canal at a point adjacent to the northern boundary of Glasgow. The basin was to be tidal and the channel open to the sea without locks, so that shipping could come and go from

the docks at all states of the tide. Ships going to the Forth were to enter the sea gates from the basin, and so avoid crowding the Clyde at the junction of the canal.

The "S.O.S." message of "Glasgow's Danger!" sent out in the circular issued in 1917 as a slogan to be renewed on various subsequent occasions, and the declaration in the "Open Letter" which followed, to the effect that the prosperity of Glasgow, the Clyde and the West of Scotland were "vitaly concerned" in the adoption of the "Direct Route" for the proposed ship canal, were sufficiently suggestive of what certainly appeared to be the chief aim by which the Canal Association was inspired, that, namely, of the protection and advance of Glasgow's own interests; but this impression must have been considerably strengthened by still another circular sent out by the Association in or about October, 1919, in which it was said, among other things:—

The importance of the canal scheme to the River Clyde and the City of Glasgow cannot be exaggerated. It would be nothing short of a calamity to river and city alike if the Government, on the advice of some great department, perhaps in a moment of haste, to provide immediate work for the unemployed, were to order the canal to proceed by any other route than the Direct Route, at sea level. It is well known that the Government hold surveys and estimates for a fresh water canal via Loch Lomond, and that the work of construction could be commenced forthwith, however futile the result might be.

It is on these lines of Glasgow's interests and the alleged superiority of the Glasgow route over the Loch Lomond route that the movement of the Canal Association has been mainly based ever since. Even on the occasion of the British Association meeting in Edinburgh in September, 1921, when—as will be shown more fully later on—papers on the Mid-Scotland Ship Canal project were read and discussed, there were handed round during the meeting leaflets once more bearing in bold type the ominous warning—

"GLASGOW'S DANGER!"

Apart from the direct activities of the Canal Association, local interest in the proposed Mid-Scotland Ship Canal was stimulated by the fact that on June 11th, 1917, the subject was discussed by the Glasgow Chamber of Commerce, which decided to "remit" it to the Home Affairs Committee of that body. The committee took the matter into consideration, received a deputation from the Mid-Scotland Ship Canal National Association, and finally resolved to report that, if the Government had decided to construct a Mid-Scotland Ship Canal, they should be urged to give full consideration to the "Direct Route," which, the committee believed, would undoubtedly be of much greater benefit to the manufacturing and trading interests of Scotland than the Loch Lomond route. The committee were also of opinion that, while the canal would not attract sufficient commercial traffic to make it remunerative, its construction along the "Direct Route" would tend to develop the important industries established along that line.

Then, also, the Glasgow and West of Scotland Branch of the Navy League sent to the Prime Minister, the Chancellor of the Exchequer, the First Lord of the Admiralty, the President of the Board of Trade and the Secretary for Scotland, under date July 5th, 1917, a resolution declaring that, inasmuch as they understood the Admiralty were "seriously contemplating" the construction of a ship canal to unite the Forth and the Clyde, the committee of the branch "would urgently and emphatically recommend" the adoption of the Yoker Route. This they did for a series of "reasons" which, in effect, were much more suggestive of special pleading on behalf of the interests of Glasgow than of such strategic or other national considerations as might more suitably have been advanced in the name of the Navy League.

Concurrently with the action thus taken by local public bodies, there was much correspondence on the subject in the columns of the *Glasgow Herald*, the main feature thereof being the vigour shown by most of the letter-writers in defending the interests in which they were specially concerned. As regarded Glasgow itself, one correspondent summed up the situation by saying, "The question is of paramount importance to Glasgow." Other views, which seemed to be widely entertained, may be illustrated by the assertion of another correspondent who expressed the opinion that the giving of a stimulus to industry on the conclusion of the war would be "more readily achieved by leading a canal through the centre of industrial Scotland, where coal and iron mines and numerous works of every description already exist, than by leading it through a district mainly pastoral." This question as to the relationship of a "Direct Route" canal to the industrial districts concerned will be dealt with in Chapter XVII.

CHAPTER XIV.

LATER PROPOSALS.

THE reports and plans prepared by Sir W. G. Armstrong, Whitworth and Co., Ltd., in respect to the proposed Mid-Scotland Ship Canal, as referred to on p. 212, were first made public early in December, 1917. They were formally presented and explained by Rear-Admiral Sir Charles Ottley, one of the directors, and Mr. William Kidd, chief of the engineering staff, at a conference of representatives of the areas concerned held in the City Chambers, Glasgow, on December 19th, 1917. The reports were three in number, namely, (1) "Report on Project for a Ship Canal between the Forth and the Clyde, *via* Loch Lomond," dated January 3rd, 1917; (2) "Report on Project for a Branch Canal for Trading Ships between Loch Lomond and the River Clyde," dated August 7th, 1917, and (3) "Report on alternative Project for a Ship Canal between the Forth and the Clyde, *via* the valleys of the Rivers Bonny and Kelvin," dated November 27th, 1917. Each was addressed to "The Secretary, Admiralty, Whitehall, London, S.W.," and each was accompanied by sheets of drawings. In effect, the first of the three reports dealt with the Loch Lomond route proper, having its exit from Loch Lomond *via* Loch Long; the second provided for a supplementary branch canal, seven and a half miles in length, designed to allow of commercial ships passing between the Clyde and Loch Lomond, *via* the valley of the River Leven, while the third related to the "Direct Route."

The reports on the alternative routes for a ship canal between deep water in the Firth of Forth and deep water in the Firth of Clyde had been drawn up on the assumption that, while serving commercial objects, the primary purpose of the canal must be for the use of ships of war. The firm had, accordingly, adopted in regard to each route dimensions not only sufficient for the accommodation of ships of war of the largest size now in existence but likely to provide for the probable growth of such ships for many years to come. Those dimensions were: Minimum width at the bottom of the side slopes, 150 ft.; depth of water, 45 ft.; clear head room above water level under bridges, 120 ft.; radius of curves, two miles. In each instance, also, it was proposed that there should be no intermediate locks, though one lock was to be provided at each end for the control of the tides, which differ both in range and in time on the Forth and the Clyde. The dimensions allowed for were greater than those of the locks on any canal, including the Panama, hitherto built. They were: Length 1,200 ft. to 1,440 ft.;

width, 130 ft.; depth of water, 45 ft.; lift of lock (maximum), 33 ft.

As regards the respective advantages and disadvantages of the two routes, the report on the one *via* Loch Lomond said that the firm had examined both and had no hesitation in coming to the conclusion that the Loch Lomond route "possessed undeniably greater advantages, particularly from the point of view of the cost of the work." In their report on the alternative project the firm stated:—"We understand that Their Lordships have decided that, before coming to a decision regarding the advisability or otherwise of constructing a strategic canal across Scotland, they desire to have the fullest information available as to the so-called Direct Route as well as the Loch Lomond Route." This further report relates to a canal which, for the greater part of its length, would follow closely the line of the existing barge canal, would maintain a minimum level of 25 ft. above Ordnance datum, and would be supplied with water from the River Carron.

The fundamental differences between the two routes were brought out in detail in the report on the alternative project, the following comparisons being made therein between the Loch Lomond Route and the Rivers Bonny and Kelvin ("Direct") Route on the basis of the two projects being designed on the same dimensions, and adequate to the accommodation of the largest war vessels:—

	LOCH LOMOND	"DIRECT
	ROUTE.	ROUTE."
Lengths—		
Distance to be navigated between deep water in the Forth and deep water in the Clyde Miles	71½	50
Total length of artificial works included in above „	44½	47½
Total length of channel to be dredged in Rivers Forth and Clyde Miles	4	18·7
Total length of rock cuttings „	15	18
Total length of soft cuttings „	25½	11
Height of ground—		
Length above 50 ft. level „	12	22½
Length above 100 ft. level „	9	20½
Total quantity of excavating and dredging	Cubic yds. 155,000,000	253,000,000
Railways to be crossed—		
Important lines	1	4
Branch lines	2	5
	—	—
Totals	3	9
Roads—New bridges required	11	19
Minerals—Coalfields, &c., to be crossed . Miles	8	28
Traffic capacity as determined by available water supply is as	6	to 1
Total estimated cost	£33,562,436	£52,072,836
Total estimate cost per mile of canal	£826,000	£1,090,530
Time required for construction Years	7 to 12	10 to 16

The "Direct Route" is shown by this comparative statement to be 21½ miles shorter than the Loch Lomond route; but of the 71½ miles included in the latter, 30½ miles are in natural waterway (*viz.*, through

Loch Lomond to Tarbet, $13\frac{1}{2}$ miles, and through Loch Long from Arrochar to the centre of the deep water channel opposite the mouth of the River Clyde, 17 miles), leaving $40\frac{3}{4}$ miles of artificial waterway, made up of 4 miles of dredged canal in the Firth of Forth, 35 miles of artificial canal between the Forth and Loch Lomond, and $1\frac{3}{4}$ miles of artificial canal between Tarbet and Arrochar. In the case of the "Direct Route" 14 miles of deepening, widening and straightening in the Clyde would be unavoidable. The same necessity would not arise, however, should the Loch Lomond route be selected, since in that case dockyards would be provided at Greenock, or in the neighbourhood of Greenock, so that there would be no occasion for the big ships in question, using the Loch Lomond route, to pass among the busy shipping of the Clyde up to Glasgow.

For these reasons the difference in the total quantities of excavation and dredging is to be noted. Then it will be seen that by the "Direct Route" more railways are crossed, more bridges are required, and twenty more miles of coalfields and mineral properties are to be passed over than by the Loch Lomond route; the last-mentioned fact suggesting that, as against any prospect of substantial local traffic in an especially important industrial district, there would have to be put the greater expense to be incurred through the acquiring of mineral rights and the need for exceptional measures to protect a ship canal, the main purpose of which would, admittedly, be strategical, against sudden collapse on account of such subsidences, due to coal workings, as have affected the existing Forth and Clyde barge canal, which the "Direct Route" scheme more or less parallels.

On the commercial aspects of the project, the firm said in their report concerning the Loch Lomond scheme:—

While the revenue to be derived from the use of the canal by commercial vessels will no doubt yield sufficient to cover the cost of upkeep and working expenses, besides providing a considerable contribution towards the annual charges of interest upon the cost of the work, we do not for a moment imagine that such a work as we are now proposing can be carried out as a profitable commercial scheme; indeed we greatly doubt whether any canal across Central Scotland, even if carried out upon restricted dimensions suitable for commercial vessels only, would be a profitable undertaking under normal conditions for many years. The project we are now proposing can only be justified by the great strategic purposes which we understand it will serve, and as to which, of course, we do not venture to express any opinion. We think it worth while to point out, however, that the advantages other than strategic which the nation would derive from the construction of this work would be very great, especially in the direction of the development of trade and commerce.

These suggested advantages included a reclamation of land on the foreshore of the Firth of Forth, offering "an ideal site for the establishment of a shipbuilding industry," and sites for large coal-shipping docks and, also, for an additional naval dockyard.

Alike at the Glasgow conference on December 19th, 1917, and in a detailed statement drawn up by Messrs. Crouch and Hogg, civil engineers,

Glasgow, in accordance with instructions received by them from the Town Clerk of that city on behalf of the Glasgow Corporation Forth and Clyde Ship Canal Committee, the Armstrong, Whitworth reports were criticized on the ground (*inter alia*) that they compared the Loch Lomond scheme with a "Direct Route" high-level fresh-water canal rather than with the "Direct Route" sea-level salt-water canal advocated by the Mid-Scotland Ship Canal Association. It was further objected that the comparative estimates of the two routes, as shown above, did not include any allowance for the estimated cost (£4,431,000) of the branch canal for trading ships between Loch Lomond and the Clyde *via* the valley of the Leven.

To these criticisms Messrs. Sir W. G. Armstrong, Whitworth and Co. replied that a high-level fresh-water scheme for the "Direct Route" project was examined by them mainly for the purposes of fair comparison with their Loch Lomond project. In view, however, of the restriction of traffic capacity due to limited water supply, they were of opinion that, if the final decision were in favour of the "Direct Route," a sea-level sea-water canal should have the preference. The adoption of this course would, however, increase their "Direct Route" estimates by £4,000,000.

Sundry other amendments made by them in their estimates left the final result, as regards the alternative routes, as follows:—

	£
"Direct Route"—Sea-water canal, with water level 7 ft. above Ordnance datum	57,572,836
Loch Lomond Route, including a branch canal to the River Clyde	38,513,004
Difference	19,059,832

The firm also estimated for a commercial canal, of smaller dimensions, for trading ships by the "Direct Route," the total amount of their estimate for this project being £31,930,206.

CHAPTER XV.

GOVERNMENT ATTITUDE.

FROM the time when proposals to supplement the existing Forth and Clyde barge canal by one of ship-canal proportions were first made, the fact has been recognized that, irrespective of any final decision as to the route to be adopted, the project was beyond the scope of private enterprise and would necessarily fail unless the Government could be induced to render financial assistance in the way of a guarantee of interest or otherwise.

The earliest of the projectors, those, namely, who were concerned in the surveys made by Messrs. Stevenson in connection with the Loch Lomond route, were certainly prepared to run a certain amount of personal risk since Sir John Jackson himself defrayed the cost of one of those surveys, and afterwards joined with the Duke of Sutherland and Lord Strathcona in providing the necessary funds for one of the others (see p. 201); though, as he told the Royal Commission on Canals and Waterways, Sir John came to the conclusion that there was no prospect of the canal being constructed without a Government guarantee. It may be added in this connection that, subsequent to the date of their first report, Messrs. Stevenson were approached by, altogether, four financial syndicates, on whose behalf they surveyed and levelled the Loch Lomond route on three separate occasions, while Parliamentary plans and estimates, with a view to the promotion of a Bill for the construction of a canal by that route, were twice completed by them. The expense of obtaining Parliamentary powers in face of the anticipated powerful opposition; the large amount of capital required for the cost of construction; the uncertainty in regard to the traffic prospects, and the element of risk involved in the scheme generally, all tended, however, to discourage private enterprise, and led to the conviction that it would be inexpedient for the promoters to become responsible for so great an undertaking unless they were assured some degree of Government support.

The National Ship Canal League, which started at Glasgow the counter movement in favour of the "Direct Route," must also have raised money for the surveys made on their behalf; but the present-day advocates of this route, notwithstanding all the resolutions they claim have been passed by local authorities in its favour, have failed to raise the comparatively small sum needed to pay for the fresh surveys now necessary, and much of their propagandist effort was for some time

directed to inducing the Government to make them a grant for the meeting of these initial expenses.

In respect to Government assistance in the construction of the canal, there was, of course, in the first instance the assumption that a guarantee of interest, at least, would be secured; but the earliest hint as to the direction which Government support might take, under certain contingencies, is to be found in paragraph (3) of the conclusions of the Committee of Imperial Defence, as given in the report of the Royal Commission on Canals and Waterways, namely—"Should there be a prospect of a canal being constructed for commercial purposes, it would then be worth while to offer some Government aid *in order to secure the conditions as laid down by the Admiralty as necessary for the passage of battleships.*"

This meant, apparently, that the assistance which might be looked for from the Government under the said conditions would be the contribution of such a sum as would represent the difference between the cost of building a canal sufficient for all ordinary commercial purposes and the cost of such enlargement thereof as would bring the canal up to Admiralty requirements. Should this be a reasonable interpretation of the words here given in italics, it follows that the promoters were to get no State aid whatever save for a recoupment of the extra expenses they incurred in giving such dimensions to the waterway as would provide for the possible needs of H.M. Navy.

QUESTIONS IN PARLIAMENT.

Between 1913 and 1917 repeated questions were put in Parliament with a view to inducing the Government to make the desired grant and, also, to ascertaining whether they were giving consideration to the general question; but, apart from what has already been stated, no further declaration of Government policy was made until June 10th, 1918, when, in the House of Commons—

Mr. J. M. Macdonald asked the Minister of Reconstruction whether he had given consideration to the suggestion which had been made for the construction of a canal between the Forth and the Clyde, and whether any decision of the matter had been arrived at.

Dr. Addison: After full consideration of the various proposals which have been submitted to them, **the Government are of opinion that at the present time no operations should be undertaken in connection with any scheme for a ship canal between the Forth and the Clyde.**

Mr. Macdonald: Can the right-hon. gentleman say whether any survey of the alternative routes has been made or is intended to be made?

Dr. Addison: There have been various preliminary surveys, with results of a very diverse character. **We have considered the question and decided not to make any further survey at present.**

This pronouncement, however, did not suggest that the Government had definitely decided against the scheme in any shape or form. It showed only that they were not disposed to do anything more in the matter "at the present time"; and the Mid-Scotland Ship Canal National Association were so far from being discouraged that, at a meeting held

shortly afterwards (see the *Glasgow Herald* for July 6th, 1918), it was decided that the propaganda in favour of a canal by the "Direct Route" at sea level should be continued until the time arrived when the Government could take up the question again and come to a decision. So it was that thenceforward the propaganda of the Canal Association in favour of their scheme was continued practically the same as before.

THE CANAL ASSOCIATION AND THE BOARD OF TRADE.

Among other developments to follow was an effort made by the Canal Association, through the Secretary for Scotland, to secure the support of the Board of Trade for their proposals.

The Board of Trade had, as what they considered "a generous estimate," put the amount of shipping likely to use the canal at 3,500,000 gross tons, and the prospective revenue at £500,000; and they had concluded that, on the basis of these figures, the revenue would not be likely to meet the expenditure. Thereupon they wrote to the Secretary for Scotland:—

While as at present advised they do not feel justified in supporting the canal on commercial grounds, they would be prepared to receive any reasoned estimate which those interested in the scheme may care to submit of the amount of shipping which it is considered might make use of the canal.

Replying under date March 18th, 1921, the Canal Association said:—

The canal has been put forward by us, not as a dividend earning project, but as a National Asset of great strategic value, and of boundless commercial possibilities, and that, for these reasons, *it should be constructed by the Government.*¹ It would be earning money and expanding the nation's commerce during the many years of Peace, and in War time would be an additional security, greatly increasing the mobility of the Navy. The Admiralty have admitted its strategic value, and the war has proved it, and it remains to convince the Board of Trade of its great commercial value.

To this end the Association proceeded to give detailed figures and calculations, based alike on saving in distance and on other considerations, with a view to showing that "an annual traffic of about 23,000,000 gross tons, equal to 14,584,590 net tons of shipping, is a moderate estimate of what might be expected to use the canal."

The Board of Trade, however, remained unconvinced. In a letter sent by the Secretary for Scotland to the Canal Association on June 29th, 1921, it was said that he had been in further communication with the Board of Trade on the question of the amount of shipping likely to go through the canal, and—

They are not satisfied that your Association's estimate is sufficiently reliable to be accepted as a valid argument for the commercial success of the canal. They note in particular that coastwise traffic accounts for nearly half their total figure, and

¹ The words here given in italics seem to suggest that the Canal Association had, for the time being, at least, abandoned the idea of getting a grant to cover the cost of an initial survey, with a guarantee of interest to follow, and were now looking to the Government to undertake the building of the canal themselves as a "national" work.

that this figure of 7,220,000 net tons has been arrived at by simply taking an arbitrary fraction of the total coastwise traffic in 1913. The Board are inclined to agree that it is in connection with coastwise traffic that the canal will afford the greatest advantages to commercial shipping, but they doubt whether the available statistics of this trade are sufficient to enable so large an estimate to be made with safety.

The Board had come to the conclusion that the only method by which a reliable opinion could be formed as to the classes of shipping which would use the canal was by comparing the saving in expenses with the amount of the tonnage which would have to be levied ; and they suggested that the Association should obtain definite estimates on this point from the shipowners concerned.

Replying on July 26th, 1921, the Association defended their previous figures and expressed the view that the Board of Trade, with their high authority and great resources, could obtain the suggested further information much better than the Association could do. The Board of Trade renewed their proposal that the Association should collect the said data, the Association re-affirmed their opinion that the Board of Trade itself was the proper body to undertake the task, and so, as far as Board and Association were concerned, the matter ended ; though before long—as will be shown in the next Chapter—there was ample testimony forthcoming as to the real amount of traffic which the shipowning interests expected to pass through the canal, if it should ever be made, together with much forcible criticism, also from the shipowners' point of view, of the Association's plans, proposals and expectations in general.

ADMIRALTY VIEWS.

Meanwhile the rivalry between the two routes continued, and in August, 1921, there was issued by the Canal Association a circular which gave some extracts from a letter stated to have been addressed by the Admiralty to the Secretary for Scotland, these extracts setting out what the Admiralty considered to be the strategic advantages of a Mid-Scotland Ship Canal, and adding :—

Although the Loch Lomond route has, from a naval aspect, many advantages over the Direct Route, their Lordships realise that the Direct Route is the only one which might possibly be a commercial success.

That the expression of this opinion was regarded with much jubilation, and made full use of for propaganda purposes, by the Canal Association, can be readily understood. The conclusions of the Committee of Imperial Defence and endorsed by the First Lord of the Admiralty, as quoted by the Royal Commission on Canals and Waterways in their final report (see *ante*, p. 207), had been made a feature in the Association's literature—save for conclusion No. (4), which was judiciously ignored, since it said :—“ The route through Loch Lomond and Loch Long is the only one which satisfies naval requirements.” The later expression of the Admiralty's views may, therefore, well have given great satisfaction to the “ Direct Route ” advocates, the Canal Association saying on one of

their circulars—headed “The Admiralty and a Mid-Scotland Canal”—“These advantages have been pressed by this Association for years, and are now admitted with a word of comment which disposes of the Loch Lomond Route.”

It will, however, have been noticed that the balance of advantage here declared by their Lordships in favour of the “Direct Route” is based on their view that this route is “the only one which might possibly be a *commercial* success.” Such expression of opinion by them was not consistent with the view taken by Dr. Macnamara when, as Parliamentary Secretary of the Board of Admiralty, he said in the House of Commons on May 23rd, 1917, in reply to Major Chapple, who asked if the First Lord of the Admiralty would, in his inquiry into the question of a Mid-Scotland Ship Canal, be disposed to make use of data collected by the Canal Association concerning the strategical and commercial value, etc., of such a canal:—“The Admiralty have, I think, already had before them such data as are necessary to form an opinion on the naval aspects of the proposed canal. *Its economic aspects are, I need hardly point out, not a matter for the Admiralty.*” When, also, Major Chapple further asked “whether due regard will be given to the commercial value of the canal in order that the two rival routes may have consideration given to them both from the naval as well as the commercial aspect,” Dr. Macnamara repeated:—“*We are concerned only with the naval aspect of the matter.* I have no doubt that those responsible will give proper consideration to the commercial interests involved.” It was, therefore, certainly singular that, after thus disavowing an aspect of the question with which it was not concerned, the Admiralty should have admitted even the possibility of a “Direct Route” canal becoming a commercial success—the more so considering that the Board of Trade, which had gone into this very matter only a few months earlier, had evidently come to the conclusion that the canal could *not* be made to pay.

In any case there was soon to be another and more decisive statement in regard to the attitude of the Admiralty on the main question, as the following extract from the official report of the proceedings in the House of Commons on October 27th, 1921, shows:—

Mr. J. Wallace asked the Prime Minister whether, in view of the large number of unemployed in Scotland, he has considered with his advisers the construction of a Mid-Scotland Ship Canal, and whether he is aware that in many quarters this scheme is regarded as likely to be financially remunerative and has, also, the strong support of the Admiralty.

Mr. Pratt (Parliamentary Under-Secretary for Health, Scotland): The scheme to which my hon. Friend alludes has been considered with reference to the question of unemployment. I am not aware that there is any convincing evidence that the scheme would be financially remunerative. **I am informed that in the opinion of the Admiralty the strategical advantages of such a canal are not of sufficient importance to justify the Government in incurring at the present time the expenditure which would be involved.**

The concluding words of this reply would further lead one to assume that the Government had considered the matter from the point of view

of their having to provide the funds for the undertaking throughout—a possibility which might well have been based on the statement made in the Canal Association's letter of March 18th, 1921, wherein they had represented that, for the reasons given (p. 222), the canal "should be constructed by the Government."

An opportunity was thus afforded to the promoters—who had ever shown a remarkable facility in adapting their line of policy to new conditions—to revive the matter afresh. Hence, doubtless, it was that, in the House of Commons on November 9th, 1921—

Mr. Kennedy asked the Prime Minister whether his attention has been called to the proposal for a Forth and Clyde Ship Canal; whether he is aware that if the Government will sanction the scheme it will not involve the Treasury in any financial outlay at present as there are firms who are prepared to finance the scheme until the completion of the work, and whether, in view of the necessity for opening up every possible avenue of employment and of the fact that the canal would be a profitable asset to the nation, he will consider the possibility of sanctioning the commencement of the scheme without delay.

Mr. Pratt (Parliamentary Under-Secretary for Health, Scotland): As stated in my reply to the hon. Member for the Dunfermline Burghs on October 27th, the proposal mentioned has been considered with reference to the question of unemployment, but **the scheme is one that cannot be undertaken by the Government at the present time.** I am not aware that any firms are prepared to finance the scheme during construction; but even if such were the case, these firms would require to be fully recouped, and the financial position of the Government would be practically the same as if it had borrowed the necessary money in the ordinary course. With regard to the suggestion that such a canal would be profitable, I refer my hon. Friend to my previous reply.

Notwithstanding the further set-back given to the movement by these renewed declarations of Government policy, the form taken by the statements made still left the situation practically the same as on June 10th, 1918, in so far as related to the unwillingness of the Government to take any further action in the matter "at present"—though, inferentially, without prejudice to anything they might be disposed, or in a position, to do later on.

So it was that once again the controversy was continued the same as before, and it was to reach, in the autumn of 1921, an almost acute stage in which the interests concerned were more especially those of the Port of Leith.

CHAPTER XVI.

ADVERSE VIEWS OF LEITH.

UNDER existing circumstances the port of Leith, situate on the southern shore of the Firth of Forth at a point two miles distant from the city of Edinburgh, is the marine gateway through which great quantities of food-stuffs, raw materials and manufactured articles pass between, on the one side, Scotland and the North of Ireland, and, on the other, ports along the east coast of Great Britain and countries on the other side of the North Sea, in the Mediterranean and elsewhere. Without being herself a producer or a consumer to any great extent, Leith has for many generations fulfilled an important rôle as a collector and distributor of Scotland's export and import trade, doing this the more efficiently in modern times because of the excellence and completeness of the railway communications by which the port is served.¹

Hence it is that Leith, jealous guardian of the open door through which this trade and traffic has hitherto flowed, has felt specially concerned in the Mid-Scotland Ship Canal projects, and has had a good deal to say about them.

TRADE INCREASE OR TRADE DIVERSION ?

Assuming that the said canal were made as a sea-level waterway by the "Direct Route," and that it fulfilled all the objects sought to be obtained, there is the possibility, if not the probability, that much of the traffic now handled at Leith would pass on to Glasgow to be dealt with there, and that Leith would suffer proportionately. The situation which might be expected to arise would, in fact, be not so much an *increase* as a *diversion* of Scottish trade; and such diversion—to the advantage of their own local interests—is evidently desired and anticipated by the Glasgow supporters of the "Direct Route" scheme.

In a communication addressed by the Mid-Scotland Ship Canal National Association to the Secretary for Scotland under date March 18th, 1921, it was said:—"The canal would attract traffic which at

¹ In *Leith and its Industries*, the official handbook of the Leith Chamber of Commerce, it is said:—"Leith is the port on the east coast of Scotland of easiest access, and, as eastern commerce cannot successfully use ports on the west, the development of Leith originated early enough to rank it to-day as indispensable for maritime purposes without claiming the monopoly which dulls the keen edge of enterprise. The system of efficient warehouses, sheds and docks, the attendant railways, the splendid service of shipping, together with the ability displayed in the conduct of her industries and commerce alike, place the town in a position to create some unusual and unique economies for the fostering and encouraging of trade, and to function as the chief gateway on the eastern seaboard."

present is discharged at other ports, and is brought to Glasgow by rail, viz. :—Wood, grain and jute from the Baltic ; fruit and wine from France ; food from Norway, Holland and Belgium ; ore, granite, paper, etc., from Norway and Sweden ; ironwork from Belgium ; fish traffic from the North Sea.” The “ other ports ” at which these commodities are now received are Leith and (to a less extent) Grangemouth ; but the carrying of traffic past those ports in order that it might be taken a few miles further by water to Glasgow—where much if not most of it would still have to be transhipped into railway wagons for conveyance to ultimate destination—would surely not count as a substantial argument in favour of a canal scheme likely to cost so many millions of money, however welcome such diversion might be to the commercial interests of Glasgow. The communication in question further said :—

Glasgow would become a much greater distributing centre than at present, particularly if large docks and warehouses were made on the canal, near to the city, as planned, where ships for Glasgow could be berthed, apart from those passing from sea to sea. The largest British, American and Continental ships would thus be able to make Glasgow a safe and convenient place of call through the straight, wide, deep and sheltered channel of the canal.

Apart from this confirmation of the apparent aim that Glasgow should become “ a much greater distributing centre ”—at the expense of her neighbouring ports—one might further point out that the cost of constructing the said docks and warehouses near to the city of Glasgow would necessarily be very substantial, that this item is not allowed for in the published estimates of the cost of constructing the canal itself, and that any saving in railway freight between Leith or Grangemouth and Glasgow—the ultimate costs of transhipment and handling being regarded as approximately the same—could not be regarded as an argument in favour of so prodigious an expenditure as the provision of a sea-level ship canal on the lines projected would involve.

VIEWS OF SHIPOWNERS.

Apart from the defence of her own particular interests, Leith is further entitled to be heard on the general question as to the practicability of the canal scheme in itself ; and in this connection it may be of interest to give here the following outline of views expressed to the present writer, in the course of conversation, by one of the leading representatives of Leith’s shipping industry :—

Not a single shipowner in the country is backing the scheme. From our point of view it is absolutely of no use. If the canal saved double the distance it would hardly be worth our while to use it. We should experience the difficulties inseparable from navigation in narrow waters. A very small accident would suffice to cause delay and eliminate all the advantages the canal would otherwise offer. There would, also, be great danger of delay if they got on the Clyde anything like the amount of additional traffic that would be wanted to pay even the working expenses of the canal. There might then be an absolute loss of time instead of a gain. Shipowners would assuredly prefer still to send their vessels round by Pentland Firth. Whatever the dangers and delays experienced

by sailing ships in former days, wrecks are fewer there to-day than, perhaps, at any other point on the British coasts. For modern steamers the voyage round the north of Scotland has no terrors and but little danger. There would, indeed, be a greater sense of security on that route than in a very narrow artificial waterway since in the former case a captain would have more space in which to navigate his vessel.

As for the idea that you should send ships crippled in the North Sea through the canal to be repaired in the ship-building yards on the Clyde, that in itself is a fallacy. The building of ships is one thing. The repairing of them is another. Glasgow is pre-eminent in ship-building, but for the repairing of ships she is the poorest port in Great Britain. You cannot put damaged ships alongside a ship-building yard. If you want dry docks for the repairing of ships damaged in the North Sea, you should build them in the Forth. If you build them for the Navy, build them where the Navy can utilise them with the greatest facility, the least risk, and at far less expense than would be involved in constructing a canal to take them to the other side of the country.

Lest it might be suggested that the views thus far expressed, or reproduced in the present Chapter, are prejudiced by an undue regard for Leith's own interests, the fact should be mentioned that even ship-owners of great experience in Glasgow and elsewhere have shown that they are under no misapprehension as to the doubtful utility, in a commercial sense, of a "Direct Route" Mid-Scotland Ship Canal. In December, 1917, there was held in the City Chambers, Glasgow, a meeting of representatives of local public bodies to hear explanations, on behalf of Messrs. Armstrong, Whitworth and Co., of the reports prepared by that firm on the alternative routes for the construction of a Forth and Clyde Ship Canal; and among those who spoke on the occasion, as subsequently reported in the *Glasgow Herald*, was Mr. (now Sir) F. C. Gardiner, shipowner and convener of the committee appointed by the Glasgow Chamber of Commerce to deal with the ship canal question. He said the Chamber of Commerce were of opinion that a Mid-Scotland Canal, while it might be of some advantage, could never in any sense be a commercial success. Another speaker, Mr. T. Paterson Purdie, Chairman of the Clyde Steamship Owners' Association, declared there could be no inducement for ocean-going ships to use a Mid-Scotland Ship Canal. He thought, also, that 40,000 or 50,000 men could be far more usefully employed in this country after the war than in navvying a canal.

Still further, the following passages might be quoted from an article published in the issue for February 21st, 1918, of *Fairplay*, the London shipping paper, which has so long been noted for the clear and fearless expression of its views, and can be trusted to take an impartial attitude on the questions here at issue:—

One of the first results of a ship canal between the Forth and the Clyde would be to divert trade from Leith, and to decrease the importance of its harbour as the principal distributing centre for Scotland. . . .

There is not the least danger that anything in the nature of a big ditch will be constructed until there has been what the American would call a thorough "probe" of the whole situation. If such a process—when, if ever, it does come—does not expose the shallowness of all the pro-canal arguments it will be very surprising indeed.

The advantages to shipping and general trade would be infinitesimal as compared with costs of construction and maintenance—so much so that the great majority of ocean-going vessels would prefer, in times of peace, to go north-about or south-about rather than incur the delays and inconveniences of such a passage, not to speak of the expense.

Following on these general observations, it may be of interest if there is now offered here an account of the action taken by various representative bodies or individuals at Leith in connection more especially with the proposed Mid-Scotland Sea-Level Ship Canal by the "Direct Route."

LEITH DOCK COMMISSION.

On the reports prepared by Messrs. Armstrong, Whitworth and Co., Ltd., being made public in December, 1917, the Leith Dock Commission appointed a special committee "to consider the desirability of their taking action in regard to the movement now on foot for establishing deep water canal communication between the Firths of Forth and Clyde." The report of this special committee, bearing the signature of Mr. Alfred M'Intosh, Convener, was presented to the Dock Commission in February, 1918.

Dealing, in the first place, with the suggestion that the proposed ship canal would secure sufficient revenue from commercial vessels to meet, ultimately, at least the cost of maintenance, the committee said that no estimate as to the amount of this cost had been given; but the constant outlay in maintaining the depth of the dredged approach channels, extending in the case of the "Direct Route" to upwards of eighteen miles, would alone prove a very costly item. Whatever grounds Messrs. Armstrong, Whitworth and Co. might have for arriving at their expectation, the committee had "no hesitation in stating definitely that the commercial traffic would never, in any circumstances, yield a return approaching the cost of maintenance."

In alluding to the commercial use of the canal, the committee went on to say that, while the saving in distance, applying to an inconsiderable traffic in coasting and short sea trades, or vessels moving in ballast from central east to central west ports, or *vice versâ*, might be of advantage, the reduction in time did not correspond with the saving in distance, owing to slow steaming in the canal, delays at locks, and, at times, pilotage delays. The question of cost involved by use of the canal had also to be considered. The case for the promoters of the canal as a commercial proposition must rest upon its extensive use by ocean-going vessels since the coastwise trade could never contribute any appreciable proportion of the cost of maintenance.

As regarded ocean traffic, Leith was the port which, from its geographical position, should be the greatest gainer; but the saving in distance from Leith to any port on the North American continent would be only 160 miles, and to South America, the Mediterranean and the East, about 200 miles, representing, approximately, for a cargo steamer of 10-knots' speed, a saving of sixteen hours in the one case and of twenty hours in

the other. For all ports outside the Forth the saving in distance by the canal route would diminish or disappear altogether. "These," said the committee, "are the undeniable features that govern the situation. They do not seem to have been considered by the promoters, who appear to have been fascinated by the fancied advantages of a 'short cut' without giving any heed to its drawbacks."

No data had been provided as to the rates that might be considered reasonable; but, taking the case of a typical cargo steamer, and putting the canal dues at only sixpence per gross ton, the committee showed that there would be an outlay of about £150 for, at best, a saving of a few hours, while, after allowing for inevitable delays, the saving in time might become a negative quantity.

A second factor against the canal was the risk of damage to vessels using it, and especially the risk of collisions, whether in thick weather, in crowded fairways or otherwise. The Clyde was subject to dense fogs during which navigation was either stopped altogether or rendered extremely dangerous. The Forth was by no means free from similar fogs. "These considerations," the statement proceeded, "apply with special force to ocean-going steamers of large size and considerable draught, and no one, either as an owner or navigator, will entertain the risks inseparable to navigation of a long stretch of narrow waters unless there is a clear, definite advantage as a set-off to the drawbacks. In this case there is none." The committee adduced other reasons for the conclusion that the canal would be of no use for ocean-going vessels, and they concluded this section of their statement by remarking that—

The claims of promoters to the ocean-going traffic bound to and from the east coast of Britain and also the Western Continent with North America and to the Mediterranean and eastwards thus become illusory, as without this traffic the value of the canal on commercial grounds disappears.

The committee next dealt with the views of those who favoured the construction of the canal by the "Direct Route" on the assumption that it would be a great factor in promoting industry on its banks; and here they said:—

It seems to your committee that the district in question is not particularly suitable for development. It is a very different proposition from the area served by the Manchester Ship Canal.

The district which the canal would traverse has been served by the Forth and Clyde Barge Canal, one of the best of its kind in Britain. Railways intersect the area east and west and north and south, and it possesses Grangemouth, one of the best and cheapest of our smaller ports, at its eastern end, and, at its western end, the great port of Glasgow. According to the promoters a ship canal of the largest size is also required to develop the possibilities of this remarkable region. While such development is the ostensible aim of the promoters, it is the opinion of your committee that the canal might do more injury to the district than any local benefits could compensate.

Then it was pointed out that of the twenty-nine miles to be traversed by the proposed canal along the "Direct Route" the land surface for

over twenty miles was 100 ft. and upwards above the sea level. In addition, therefore, to the heavy cost of cuttings for the canal itself, allowance would have to be made for the provision of recessed wharfage accommodation in these high banks, for access thereto, and for the cost of connecting the anticipated new industrial undertakings on the tops of the banks with the railways. Altogether, the committee were of opinion that, if commercial development were called for, alternative facilities would be found to much greater advantage elsewhere on the Firths of Forth and Clyde.

Much, again, has been said as to the valuable purpose that a ship canal by the "Direct Route" would serve as a means of transporting damaged warships to the Clyde for repair; but the committee suggested that those who entertained this idea overlooked two material facts.

One is that in this kind of repair work the measure of capacity is dry docks, not shipbuilding yards; and the Clyde is, relatively, poorly supplied with the former. This is not due to any want of enterprise on the part of the Clyde Navigation Trustees but to the difficulty attending the provision of large dry docks with access from the narrow channel of the upper Clyde. The docking and undocking of vessels, especially of large size, proves a temporary obstacle to traffic.

The other fact is that to risk a damaged ship blocking the canal or its dredging approaches is an adverse element which must be contemplated.

The criticism of the committee was mainly confined to the proposals affecting the "Direct Route." As regards the alternative route by Loch Lomond, they recognized that it had several manifest advantages over its rival, since the water supply of the former was ample; it avoided the congestion of the narrow navigable waters of the upper Clyde; the line of the canal from the Forth up to Stirling passed through country that was both fertile and adjacent to the Bannockburn coalfields, producing coal of fine quality, while, as a further argument in favour of the Loch Lomond route, "the estimated constructional cost is," it was added, "so much lower that there is virtually no comparison between it and the cost of its rival, and the maintenance cost (a most important element) would be much less, chiefly due to the fact that only four miles of dredged channel have to be maintained as against 18·7 miles."

The committee admitted that, as against all this, there was the drawback of the longer route minimizing the advantage of coastwise traffic between Glasgow and the east coast.

Finally they expressed their opinion that "the construction of the canal"—presumably by either route—"ought not to be undertaken from any false idea of commercial prospects, but only on the ground of national necessity if the Government should be so advised"; and they recommended that the Leith Dock Commissioners, as administrators of a national undertaking, should take measures for securing—

(1) That no decision shall be arrived at and no action shall be taken upon the proposals now put forward for establishing deep water communication between the Firths of Forth and Clyde except upon the ascertainment and full consideration

of the facts relating to the possible value to commercial shipping of such communication and the revenues to be derived from that source.

(2) That a formal public inquiry shall be held as to the commercial as distinguished from the strategical aspects of the proposals.

The report was considered and approved at a meeting of the Leith Dock Commission held February 6th, 1918.

LEITH CHAMBER OF COMMERCE.

Among other propagandist efforts which, as honorary secretary of the Forth and Clyde Canal Association, Vice-Admiral Sir Charles Campbell made in 1909, was the addressing to the newspapers at Leith of a letter in which he said, "I desire through your columns to direct the attention of Leith to the great value of the proposed canal to the port." Much local discussion of the subject followed, and, among other phases thereof, the matter was dealt with at a meeting of the Leith Chamber of Commerce held November 8th, 1909.

At this meeting the Chairman of the Chamber stated that a letter and documents sent to them by the Vice-Admiral had been considered by the directors. While feeling that it was not for them to deal with considerations of naval strategy and imperial defence, he had formed the opinion, after having for many years given very careful attention to the subject, that, even if the canal were constructed, it would be of comparatively little use to commerce, and could not possibly be made to pay as a business proposition. He had calculated that at least 27,000,000 tons of shipping per annum would have to pass through the canal to enable it to pay its way, and it was impossible to see where such an amount of tonnage was to come from. No shipowner dealing with large ships would use the canal if he could help it, while the saving of distance from, for example, the west of Continental Europe to New York would be a negligible quantity.

The Chamber concurred with the views expressed by the Chairman, and a resolution expressing disapproval of the scheme was unanimously carried.

On February 25th, 1918, the Chamber reconsidered the subject, in view of the additional information afforded by the Armstrong-Whitworth reports. It again passed a resolution disapproving of the scheme and stating, among other things:—

While the canal would effect a certain saving in distance in particular voyages, that saving would be seriously offset by the waiting for turns and pilots, the working of locks, and the delays incident to the use of a narrow waterway. Any saving of time would be too insignificant and too uncertain to tempt vessels to incur the cost of transit and the inevitable risks of damage.

Lying as it does at the eastern end of the proposed channel, Leith is in the most favourable geographical position for taking advantage of such benefits as the canal is intended to offer. The Chamber of Commerce, however, representing the opinion of the business community of Leith, submits that, whatever other considerations may be brought forward as justifying so heavy a public expenditure, the scheme should not be proceeded with on the ground of business advantage, nor on the idea that it can prove a commercial success.

Once again, on November 14th, 1921, the Chamber discussed the matter, and on this occasion it was agreed that—

Leith Chamber of Commerce, observing that public attention is again directed to the project of constructing a ship canal between the Forth and Clyde, unani- mously re-affirms its opposing opinion expressed by resolutions adopted on 8th November, 1909, and 25th February, 1918. Nothing has transpired in the interval to convince the Chamber that the commercial advantages advocated by the pro- moters are sufficiently substantiated to justify any recommendation to the public to support the scheme in respect of the enormous capital expenditure contemplated.

The Chamber, representing the highly industrial and shipping community of Leith, submits that the facilities proposed by this waterway are, for commercial purposes, altogether unnecessary, in supplement of those already operating.

LEITH SHIPOWNERS' SOCIETY.

On May 17th, 1918, the Leith Shipowners' Society unanimously adopted a resolution affirming that it was not in favour of the project, disapproving of the efforts made to get the Government committed to such an undertaking, declaring against it as a commercial proposition, and adding :—

The works would certainly be of a very costly character, the expenses of upkeep heavy, and the revenue on any well-considered and responsible calculations would be so utterly inadequate that public support would not be forthcoming, while the expectations formed in some quarters of new industries arising out of it are not well founded, and are in any case quite problematical. Over and above this, with a colossal debt to carry for many years to come, the nation is in no position to undertake any such responsibilities without which the work could not be carried out.

The same resolution was passed over again by the Society at a meeting held February 1st, 1922.

BRITISH ASSOCIATION MEETING AT EDINBURGH.

The annual meeting of the British Association in 1921 was held at Edinburgh, and the items set down on the programme of the proceedings on September 12th included the reading, at a joint meeting of the Geo- logical and Engineering sections, of technical papers by Mr. Murray Macgregor and Mr. C. H. Dinham on the rival schemes for a Mid-Scotland Ship Canal.

When the technicalities had been disposed of, addresses in regard to the general aspects of the two schemes were given by Mr. D. A. Stevenson, Edinburgh, in respect to the Loch Lomond scheme, and by Mr. Robert Bird, Glasgow, on the " Direct " scheme. Mr. Bird is reported to have said that " they had satisfied the Admiralty, but they had yet to convert the Board of Trade " ; though the statement subsequently made in the House of Commons (see p. 224) was to show that the Admiralty had not really been satisfied, while there is no reason to doubt that the Board of Trade are still awaiting conversion.

In the discussion which followed, Mr. H. A. Salvesen, shipowner, of Grangemouth, expressed views which fully confirmed what has already

been said as to the hostile attitude of the shipowning interests in general to the canal idea. From his experience of shipping, a tramp steamer going from Glasgow to the Baltic would, by using the canal, save only two days in time and have a dead loss of £304 in money. In his opinion the whole scheme was "absurd and impossible from a commercial point of view." Mr. Salvesen further said ¹ :—

After a long business experience in Grangemouth, I now find that, with the improvements made in the railway service, the best method of distribution for all kinds of goods in the Central, Eastern, and Western parts of Scotland is by means of the railway direct into the sidings of various industries. And, vice versa, the same applies to the goods for export, which can best be shipped at Grangemouth. I am therefore firmly convinced that no Mid-Scotland Ship Canal in any shape or form will be able to compete commercially with the system of importing goods to Grangemouth and distributing them by means of the existing canal or the railways to their various destinations.

Mr. H. M. Cadell, of Grange, Linlithgowshire, speaking as a coal owner, said that the cutting through carboniferous strata of a deep trench, and the filling of it up with water, along the route of the "Direct" canal would have the effect of saturating them and drowning out all existing colliery workings for some distance on each side of the canal. At present many of the coalfields were protected by a layer of clay which, stretching over the rock, kept a good deal of water out; but a canal at sea level would go so deep down that it would pass through the clay into the rock, filling it up with water and making any further mining there unprofitable. He further objected to a "Direct Route" canal because the cutting of a "chasm" for ten miles or more along the watershed would interrupt communications and require, for roads and railways, bridges higher than the Forth Bridge. Then again, once started, the work would have to be completed in order that it should not become a public nuisance, and the Government or whoever else undertook to provide the funds would be committed to a vast unknown expenditure on an undertaking which would probably never pay 1 per cent. on the outlay. He was firmly convinced that the money could be better employed in other directions.²

The proceedings showed what the chairman on the occasion spoke of as "a remarkable diversity of opinion"; but, incidentally, the announcement that the subject would be discussed had also led to an

¹ A full report of Mr. Salvesen's address, giving a detailed criticism of the "Direct" scheme, from a shipowner's point of view, was published in the issue of the *Falkirk Herald* for September 17th, 1921.

² Mr. Cadell, by whom these remarks were made, is a distinguished authority in Scotland on mines, minerals, land and other cognate questions. He contributed to *The Scottish Geographical Magazine* for May and June, 1918, two illustrated papers on "Industrial Possibilities of the Forth Estuary," in which, referring to the "Direct Route" Ship Canal Scheme, he pointed to the difficulties which would arise, and the possible prejudice that might be done to the Forth Estuary, in disposing of the 253,000,000 cubic yards of material which would require to be excavated for the purposes of the cutting, and he further said :—"If a hundredth part of the proposed expenditure on an unremunerative speculation were devoted to the development of the Forth estuary and the utilisation of its great natural resources, the return would not only justify the outlay but would in the end assuredly repay it many times over."

important development in another direction, and one in which Leith was directly concerned.

MR. MALCOLM McDONALD'S MEMORANDUM.

Shortly before the meeting of the British Association, though in anticipation thereof, the Mid-Scotland Ship Canal Committee of the Edinburgh Town Council took the unprecedented course of co-opting a gentleman who was not already a member of the Town Council, namely, Mr. Malcolm McDonald, J.P., a member of the Leith Chamber of Commerce and of the firm of James Currie and Co., Leith, managers of the Leith, Hull and Hamburg Steam Packet Co., Ltd. The service Mr. McDonald was desired to render was that of, as a shipowner, assisting the Committee with practical considerations arising in regard to the Mid-Scotland Ship Canal project, while he was, in the first instance, specially asked to prepare a detailed memorandum on the whole scheme, for the information of the committee, the Town Council, and others interested. Mr. McDonald undertook the task, and the memorandum, when printed by the Edinburgh Town Council for distribution among its members, made a document of twenty-nine foolscap pages. Dated "Leith, September, 1921," it constitutes the most detailed and complete criticism and condemnation of the scheme which had been issued down to this period.

After dealing with the earlier history of the project, Mr. McDonald refers to the naval and strategical aspects of the questions which have been raised. In this connection he says it had been represented that the canal would provide "a back-door to Rosyth and to the shipbuilding and repairing yards of the Clyde"—a statement which implies that the intention was to transport to the Clyde for repair war-vessels which might have sustained damage in the North Sea. During the war vessels belonging to or in the service of the Admiralty made in very large numbers for the Firth of Forth—principally going to Leith and Rosyth—for dry-docking and repair after sustaining damage in action or otherwise in the North Sea. These injuries were, in the majority of cases, to hull, to machinery or to steering gear.

The vessels with injury to hull were frequently in a leaky or even sinking condition; and Mr. McDonald suggests that to transport ships in such a state as this some twenty or five-and-twenty miles up the firth, beyond Leith, to the canal entrance and through the entire length of the canal to the Clyde, and then manœuvre them into a ship-repairing yard or dry dock on that river, would mean subjecting them to a serious risk of sinking in the Forth, in the Clyde, or in the canal itself. In the last-mentioned case there would be the further possibility—if not probability—of sealing up the waterway for weeks or months.

Where the damage done was to machinery or steering gear, the vessels would have to be towed or steered through the canal by tugs, with such risk to the vessels themselves, to others, or to the canal works that the need might arise of practically monopolizing the use of the canal for the time being.

Even if such damaged vessels could be taken along the two rivers and the canal without mishap, it might be found that it would be better in many respects to have the repair work done on the east coast. "For," says Mr. McDonald—

Notwithstanding that the Glasgow area is undoubtedly the greatest shipbuilding centre in the world, it is behind the Firth of Forth in dry-docking accommodation. And, besides, it may be remarked that owing to the positions of the Clyde dry docks, the whole shipping traffic is sometimes held up for an appreciable time while the docking or undocking of vessels is being effected. No such inconvenience is ever experienced at Leith, Grangemouth or Rosyth.

By such trenchant facts and arguments as these, Mr. McDonald would certainly appear to have disposed effectually of one, at least, of the main arguments advanced in favour of a "Direct Route" sea-level canal. He supplements them by giving an interesting account of the Port of Leith's own war-time record, showing that the total number of vessels belonging to or working for the Admiralty or War Department which visited Leith from the outset of the war to Whitsunday, 1921, was 38,621. Of these a very large proportion underwent repairs, refitting and dry-dock work, while others were provided with stores, fuel, etc.¹

Mr. McDonald deals no less effectively with another of the principal arguments consistently advanced from the very outset by all advocates of whatever route for a Mid-Scotland Ship Canal—that, namely, which relates to the possible saving in distance by means of its use.

Looking simply at the map, the saving in respect to many of the ports specified may appear to be not inconsiderable; but Mr. McDonald suggests that, in a large proportion of the instances which would arise in connection with places in Scotland to be served by a "Direct Route" Ship Canal, it is already a rare occurrence for, say, twenty tons of goods to be handled in one consignment, and even if, on occasion, a substantial quantity of goods had to be conveyed between the points in question, suitable craft carrying seventy, eighty or ninety tons could be quite readily obtained to take them through the existing Forth and Clyde Barge Canal. This same route would, also, still be preferred in all such

¹ Mr. McDonald states that within the period from the outbreak of hostilities up till Whitsunday, 1921, when the most recent Return was compiled, Leith was visited for various purposes by vessels belonging to, or in the service for the time being, of the Admiralty and War Department, to the following numbers:—

Cruisers	29
Gun Boats	9
Torpedo Boats, T.B. Destroyers and Submarines	2,935
Hospital Ships	58
Fishery Board Cruisers	1,495
Repair Ships and Salvage Vessels	3
Mine Layers, Mine Sweepers and Drifters	8,119
Tugs, Launches and Yachts	13,418
Lighters, Hoppers and Barges	1,094
Weight Lifters and Diggers	285
Oil Tankers	99
Transports, Colliers, etc.	4,147
Water Boats and Tenders	6,930
Total	38,621

cases as these even if the ship canal were provided, since the transit scale on the latter would necessarily have to be on a higher scale than on the former.

Taking, next, the traffic passing between home and overseas ports, Mr. McDonald shows that the savings in geographical distance are not to be taken as the measure of the shipowner's saving in time. On the open sea a vessel of average speed, say ten knots per hour, can keep up a speed of ten knots; but in passing through the canal it would have to reduce speed to, say, five knots, and even then there might be delays due to waiting for pilots, prevalence of fog, or other possible causes of detention. The actual saving in time might thus be either a negligible quantity or non-existent, while canal dues on vessel and cargo, together with the substantial charges for pilotages in the Firths of Forth and Clyde and in the canal itself, would still have to be paid. A number of examples are offered in support of these views.

The published list of anticipated savings for "Direct Route" traffic also refers to steamers trading between Leith and Liverpool and Leith and Belfast. In the former case the saving in distance is put at 400 miles and in the latter at 377 miles. Here, again, the same considerations as those offered in the last paragraph would arise—and others besides. The vessels in question do not obtain anything like full cargoes at either of their terminal ports. They call, *en route*, at quite a number of places, either to discharge cargo or to take on board fresh consignments. Thus, Mr. McDonald goes on to say:—

In the course of a Liverpool-to-Leith run, a steamer may call at Oban, Stornoway, Stromness, Aberdeen and Dundee. She does this because there are always goods, and usually passengers, for or from these different places from or to one or more of the others; and it may be accepted as certain that, even if the proposed canal were made, and even if free transit were offered, she would make no use of it. "North-about" there are goods and passengers to be carried; and she is after these. The existence of the canal is not of the slightest interest to her. The same remarks apply, *mutatis mutandis*, to the Belfast and Leith trader.

Mr. McDonald passes on to the question as to the volume of traffic which, according to the Canal Association, could be expected to use the canal if it were made, namely, 14,584,590 net tons, or 23,000,000 gross tons, of shipping; and he ridicules the assumption, claiming it to be nothing more, that such an amount of tonnage could be depended upon to pass through the canal on account of saving in distance, or for other reasons. Alluding especially to the Association's estimate that one-eighteenth of the coasting traffic of the United Kingdom would use the canal, he describes it as "pure assertion, or imagination—and equally groundless in either case"; while in summing up the general position in regard to this aspect of the question, he says:—

Viewing these estimates of traffic as a whole, the feeling is forced upon one that it would not be easy, if indeed it were possible, to cite an example equal to this of how to "conjure up" anticipated traffic. We are asked to believe that the projected waterway, if constructed, would attract to itself yearly an amount of tonnage be-

tween five and six times the total which in the twelve months ending Whitsunday last [1921] entered and cleared from the Port of Leith, which was 1,421,836 tons inward, and 1,398,368 tons outward. Put otherwise, the claim is that it would succeed in securing an amount of tonnage not far short of 85 per cent. of that (roundly 17,567,000 net tons) which, after over half-a-century's amazingly successful working, made use in 1920 of the Suez Canal—the greatest of the world's maritime highways by which the distances between London and Bombay and between London and Calcutta were reduced by 4,563 miles and 3,667 miles respectively, and through which, hour by hour, our modern argosies pass to their desired havens, bearing with them the wealth and commerce of the nations, North and South, East and West. Or, still otherwise, if the average net tonnage of the vessels anticipated to use the canal be put at 1,000—a fairly high figure since one-half of the total amount is expected to be represented by coastwise traders, which are necessarily of moderate size—the number of vessels passing through would be 14,584. If the average tonnage be reduced below 1,000 tons, as it well might be very considerably, the number of vessels would correspondingly be increased. Those which traversed the Suez Canal in 1920 numbered 4,009. In the most recent financial year of the Panama Canal the number was 2,892. Need more be said? Comment would surely be supererogatory. THE THING IS UNTHINKABLE!

On the financial aspects of the scheme, Mr. McDonald enters upon some elaborate calculations, the effect of which is to show that, in order to meet interest and sinking fund charges (spread over a period of forty years after completion within, say, fifteen years), together with maintenance charges, it would be necessary, on the method of charge proposed by the Canal Association, to put a rate of nearly 25s. per net ton on an estimated traffic of 2,250,000 tons; while even if the sinking fund instalments were dropped and no provision made for the redemption of the capital cost, the adoption of this course would do no more than reduce the rate to about 20s. per ton. Mr. McDonald remarks thereon:—

It will doubtless be said at once that anything approaching even the lower rate would be utterly prohibitive. This is quite true, and those responsible for the canal finances would at a very early stage in its history be faced with the serious alternative of having to impose a prohibitive rate if they aimed at meeting their financial obligations, or of charging an unremunerative one if they wished to attract shipping. . . . Bankruptcy or else starvation would lie before them; and they would be left to choose the "horn" upon which they would prefer to be impaled.

Mr. McDonald has, however, made one oversight, though it is one but for which the outlook he presents for the future of the project would have been still more unfavourable. He takes, as the cost of constructing the canal, the figure given in the Armstrong-Whitworth report, namely, £52,000,000, adding thereto an additional £500,000 both to allow for the inevitable extras and for facility in calculation. But, as already shown on p. 219, this estimate of £52,000,000 was for a high-level fresh-water canal corresponding with the Loch Lomond route project, whereas the canal which the Association are now projecting is a sea-level one. The firm, in response to criticisms to this effect, added £4,000,000 to their former estimates in order to meet the extra cost which would be involved in the excavation of a sea-level canal. They also, at the same time, made other amendments of their estimates, the total thereof being

eventually raised to £57,572,836. Strictly speaking, therefore, it is this figure, and not the original £52,000,000, upon which Mr. McDonald's own calculations should have been based.

One of the most persistent of the arguments advanced by the Canal Association in recent years has been the assumed good purpose which, in the construction of the canal, would be served by the giving of work to the unemployed. Here Mr. McDonald suggests that the great majority of the men now out of employment are members of skilled trades—engineers, shipbuilders, joiners, plumbers, blacksmiths, etc.—of whom comparatively few would be suited to the making of a canal. The larger number of those taken on would probably be navvies and other unskilled men accustomed to rough work. If provided, at an enormous outlay, in the interests of unemployment, the so-called “national asset” would be a drain upon some purse—national or otherwise—during all the years of its existence; and Mr. McDonald inclines to the view that, apart from the harm done to the recipients themselves by the system of doles without a reasonable equivalent in the shape of work performed, it would ultimately be found more in accordance with true national economy to *grant* one, two, or three or more millions now to relieve unemployment than to spend fifty or sixty millions or more “on what would be of very doubtful use when completed, and at the best a cause of continual expense ever after.”

The conclusions at which, after dealing with various other matters, Mr. McDonald arrives are summarized by him as follows:—

The savings of distances claimed, while approximately correct on paper, are quite illusory for practical purposes.

The statements of estimated traffic and of money-savings are unable to sustain examination.

Traffic will be diverted from existing routes rather than present trades developed or new ones created. From this Leith and Grangemouth will be the principal sufferers.

Leith has for centuries been the chief distributing centre for Scotland. The canal promoters say that Glasgow is by the making of this canal to be enabled to supersede her in that position.

Leith's resources in appliances (dry-docks, repairing yards, cranes, etc.) and in men enabled her during the war to meet, triumphantly, demands upon her services, not only immeasurably beyond what was even dreamt of before but possibly not surpassed, proportionately, by those placed upon any other port in the country. Through the medium of this canal, it is intended, much repairing work will go in future to the yards on the Clyde.

The estimates of cost have been steadily mounting up as time has passed. The latest (1917) puts it between six and seven times that given by Messrs. Stevenson in 1889. And prices have risen rather than fallen in the last four years.

The proposed charges are considered by the Board of Trade and other competent authorities to be inadequate to meet maintenance costs alone, not to speak of interest, much less that plus sinking fund instalments.

Unless a subvention of between two and three millions sterling yearly were forthcoming bankruptcy of the undertaking would ensue, because, to raise the charges to an adequate level would strangle the traffic and thus the disappearance of all revenue would come about.

Shipowners, from the nature and conditions of their business, occupy such a

position as enables them, in the opinion of the Board of Trade, to afford definite and reliable answers to certain questions involved. With one voice Firth of Forth shipowners have without hesitation declared against the canal. Glasgow owners say it could never be in any sense a commercial success, and there could be no inducement for ocean-going ships to use it.

Leith Chamber of Commerce, claiming to represent the opinion of the business community of Leith, unanimously affirmed and reaffirmed the view that the scheme should not be proceeded with on the ground of business advantage, nor on the idea that it can prove a commercial success.

Leith Dock Commission gave a reasoned and weighty report on the subject, discussing it on the broadest national lines.

Leith and Grangemouth Town Councils, like other bodies representative of the communities interested, concur in the views of those already mentioned.

The Mid-Scotland Canal Association, as in the construing by the Board of Trade of the Board's statistics, claim to know better than these various bodies what would benefit or injure the various local interests, and declare their fears and their prophecies groundless.

The "unemployment" argument has been shown to be an inexpedient proposal for dealing with a grave social problem.

The magnitude of the scheme, physically and financially, has been indicated, connoting most serious and wide-spread results in case of failure.

It has latterly been avowed by the promoters, doubtless correctly, that the construction of the canal would greatly enhance the value of land in its vicinity; and the suggestion has been made that information as to this should be obtained, and the ultimate destination of this unearned increment ascertained.¹

Before us are the results of the foregoing examination—criticism, if the latter word be preferred. The claim is now made that it has been shown in its course that, neither soon nor late, could this enormously costly project prove, in a financial or economic sense, other than an immense and disastrous failure. But in reviving and booming it at present its promoters are putting forward prominently the plea of naval and strategic requirements. One would think that a more inopportune time for this could not be chosen than the moment when reductions of armaments, alike for humanitarian and for economic reasons, are the subject of national and international communings, and while the peoples of the earth are groaning under the burdens, impossible of being much longer borne, which existing conditions impose. And if the claim just submitted is felt to be justified the duty of the City of Edinburgh in connection with this matter, dictated equally by national and by local considerations, seems unmistakably plain: so plain as not to require statement here. Upon the writer the conviction has again been forced, with added strength, that this scheme for mingling the waters of the German Ocean with those of Loch Lomond (or other of our western lochs or streams, according to the route ultimately chosen) could not eventuate otherwise than as a veritable, gigantic, twentieth century

NORTH SEA BUBBLE.

In a postscript, dated September 14th, 1921, Mr. McDonald refers to the discussion at the meeting of the British Association two days previously, saying in respect thereto:—

Leaflets issued by the Canal Association, bearing in bold type the heading "GLASGOW'S DANGER," were handed round during the meeting. In these warning is given that "the Loch Lomond route will be taken if Glasgow does not secure the direct route." The plain man here in the east may be excused if he exclaims:

¹ In the Canal Association's letter of March 18th, 1921, it is said:—"The rise in the value of land on the route of the canal, and the extensive reclamation of land at the Forth and the Clyde, are considerations which the Board of Trade should keep in view."

“ A plague on both your devices !!! ” The fact is that in the wider sense the whole project constitutes for Scotland, financially, a grave national menace ; while, regarded in the narrower, local sphere, it is equally “ EDINBURGH'S DANGER.”

Issued, on October 19th, 1921, to the Press, as well as to members of the Edinburgh Town Council, the Memorandum attracted much attention both at home and overseas. Among other journals dealing with the subject was the *Scotsman*, which, in a leading article published October 21st, giving general support to Mr. McDonald's conclusions, said in reference to the rival schemes :—

Neither of them is yet mature enough for public consideration, let alone adoption. They can be put firmly and decisively aside, awaiting the good time coming when the country will have more money to spend on luxuries like a Mid-Scotland Ship Canal, and when those who believe in it shall have settled more definitely the best route, and are able to produce more convincing figures concerning its expense, its uses, and its probable returns. On these points they have been unable as yet to produce estimates that will endure close examination.

Locally, the public opinion of Leith was fully confirmed in the views it had previously entertained. The Leith Chamber of Commerce adopted a minute expressing its appreciation of “ the good services rendered by Mr. McDonald in placing on record, for official and general information, a history of the movement in favour of the canal, followed by an array of facts and arguments in denunciation of the scheme, which this meeting regards as incontrovertible.” The Leith Shipowners' Society passed a hearty vote of thanks to Mr. McDonald “ in recognition of the public services rendered by him in the preparation of the Memorandum.” The clerk of the Leith Dock Commission, in a letter to the Town Clerk of Edinburgh with regard to the Memorandum, which most, if not all, of the Commissioners “ had read with the greatest interest,” said their attention had also been directed to the statement made in the House of Commons on October 27th, 1921, by the Parliamentary Under-Secretary for Health (Scotland), in reply to a question by Mr. Wallace,¹ and—

They decided that in view of the attitude of the Government so unequivocally announced in Parliament, it was unnecessary and inexpedient for them as a public board to divert their attention from matters of immediate practical importance, or to occupy their time in considering the statement of the Commissioners' views on this subject set out in the report by their Special Committee, approved at their meeting of 6th February, 1918.

To the conclusions arrived at in the report my Commissioners adhered ; and they desired to record their opinion that Mr. McDonald's Memorandum is a well-considered and well-informed contribution, by a man of ripe experience and sound judgment, to the mass of evidence accumulating upon the subject, and to recommend it to the careful study of those not yet fully satisfied that the scheme is impracticable, unless and until the Government find themselves compelled to adopt it on purely strategical grounds.

On April 7th, 1922, the Leith Dock Commission took the further step of appointing Mr. McDonald to fill a vacancy which had occurred in the membership of that body.

¹ See p. 224.

PART V.—SUMMARY AND CONCLUSIONS.

CHAPTER XVII.

A GENERAL SURVEY.

THE general aspects of the Scottish Canal Problem are so far interdependent that they must needs be dealt with as a whole.

No one, for example, has yet suggested that, assuming for the sake of argument the construction of a ship canal of modern type across the mainland of Scotland to be desirable, there is any need for *two*, even if the country should ever be willing to incur the expense of making two. Before, therefore, any definite action is taken in this direction, it would be necessary to decide, not only between the rival schemes for a Forth and Clyde Ship Canal, but, also, between both of these and the conversion of the Caledonian Canal into larger proportions. The latter would be a less costly undertaking, and it might be found the one best worth taking in hand, the more so having regard to the considerable sum which must needs be spent upon it by the State, either to keep it going or to close it down, whereas there is no absolute necessity to spend any money at all on a new Forth and Clyde Ship Canal unless the Admiralty should declare—as they are evidently not disposed to do—that such a canal is strategically indispensable to the safety and welfare of the country.

THE CALEDONIAN CANAL.

It is true that witnesses examined before the Royal Commission on Canals and Waterways were disposed to scoff at the idea of the Caledonian Canal, situate so far from the naval base at Rosyth, on the Firth of Forth, having any strategical significance as compared with a Forth and Clyde Ship Canal; but there was then no idea of what was likely to happen in connection with Invergordon and Cromarty Firth in the Great War which the near future had in store for us. Strategically, indeed, as well as commercially, the Caledonian is now entitled to consideration as well as any new undertaking for linking up afresh the Forth and Clyde; and it will acquire a still greater claim to attention if the decision should be definitely arrived at that neither of the two Forth and Clyde schemes is to be carried out. War-time experiences on the Caledonian Canal proved conclusively that any material enlargement of its transport facilities could not fail to be of advantage from a naval point of view, even although it should not be expanded—as, in fact, no one proposes—to battleship dimensions.

If the announcement were made that the Government had resolved

to take no further action at all in reference to a Forth and Clyde Ship Canal, instead of simply saying that they are "not prepared to do anything at present," it should be possible to arrive at an early conclusion as between the three courses which come into consideration in regard to the future of the Caledonian, namely, (1) a continuance of the present policy of patchwork repairs ; (2) definite abandonment, or (3) modernization and the securing of increased efficiency alike for commercial and for naval purposes by means of one or other of the proposed reconstruction schemes. Otherwise, if the principle of improvement rather than of mere repair of the Caledonian should be accepted without regard to what might or might not be done concerning the proposed Forth and Clyde Ship Canal, the uncertainty in respect to the latter would still affect the question as to which of the two improvement schemes for the Caledonian should be adopted. This would be the case because, if the Forth and Clyde project were not to be carried out at all, the Government might feel the more justified in converting the Caledonian into a really efficient national waterway of the best type by adopting "Scheme A" in preference to the less costly, though second-best, "Scheme B."

Another question which arises as between a modernized Caledonian Canal or a new Forth and Clyde Ship Canal relates to the expansion in trade, industries and traffic that each may reasonably be regarded as offering. Much has been said as to the prospects a "Direct Route" Forth and Clyde Canal would offer in these directions by reason of the fact that it would pass through what is already an important industrial district. This phase of the subject, as regards the Forth and Clyde scheme, will be dealt with later on ; but here it may be said that, although the industrial resources of the Great Glen have not yet attained to any approach to full development, they are distinctly promising if only because of the possibilities they offer in regard to the development of water power.

All the world over there is being shown a tendency to establish new industries, not so much in already more or less congested urban centres as in at present sparsely populated districts where the water power which promises to create an industrial revolution second only to that brought about by steam power can be readily obtained. This movement is inspired by, among other reasons, a desire for economy in production, since the nation which can put manufactures on the world's markets at the lowest cost will naturally have the best chance of controlling those markets. Further than this, in every country where coal and oil are to be found, scientists and economists have been taking stock thereof and finding that the available resources are not so illimitable that the future can be regarded with unconcern.

In view, therefore, of what is being done elsewhere—and notably in Canada, the United States, France, Sweden, Norway, Italy and Switzerland—for the development of water power, it is certainly desirable that every effort should be made to utilize the natural resources of the Highlands, to the advantage alike of Scotland and of the nation as a whole. It might be a matter of years before the resources in this respect offered

by the Great Glen were taken advantage of to the full extent of their possibilities ; but where, as in the case of the Caledonian Canal, money must necessarily be spent, it would be only wise and prudent that this should be done with some degree of foresight as to the transport requirements and the economic developments of what, after all, may be a not far distant future.

There can be no doubt that the provision in advance of improved transport facilities in a district which, unlike the valleys of the Forth and Clyde, has but a limited provision of railway lines, would facilitate an industrial expansion so desirable in the interests both of Scotland and of the nation, whilst an improved Caledonian Canal would offer one advantage, at least, over any new railway inasmuch as the steamers passing along it could serve equally well the works or factories situate on either side of the waterway, whereas a railway could serve those on one side only. Here, therefore, the question of competition between rail and water scarcely comes into account, though it is conceivable that each might serve a useful purpose in supplementing the other.

While, again, the Caledonian Canal has had an unfortunate experience—mainly because, by reason of its physical shortcomings from the outset, it has never yet had a fair chance of doing all that it might do under better conditions—the fact may be recalled that for eleven years prior to 1913 the revenue exceeded the expenditure by an average of £800 per annum. Nor does there seem to be any reason why a similarly favourable balance should not again be assured when the position of the Scottish fishing industry once more becomes normal, even apart from the prospect of new developments in the other directions mentioned.

THE CRINAN CANAL.

The Crinan Canal is associated with the Caledonian inasmuch as the two constitute links in a chain of through communication between the Clyde and Inverness and points beyond, are feeders the one to the other, and are so closely connected that the nearer they resemble one another in their transport facilities the greater will be the degree of advantage which, in combination, they will be able to afford. The dimensions of the regulating locks for the proposed Crinan Ship Canal—corresponding with the size of those designed under "Scheme B" for the Caledonian, would be smaller than those for "Scheme A"—but might still be ample for the ordinary type of vessels likely to pass this way *en route* either to or from the Caledonian Canal or otherwise.

A close resemblance between the two canals is also found in the fact that, whilst the Crinan dates from 1801 and the Caledonian from 1822, neither has yet been completed, both are out of date, and each is in a sadly defective condition, so that in the one case as in the other it is a question whether reconstruction would not be preferable to a renovation which would do little more than ensure a prolonged existence for deficiencies and shortcomings entirely unsuited to present conditions.

On the other hand the Crinan is much more closely associated than

the Caledonian with the economic and social conditions of the Highlands in general. It serves, especially, the small coasting vessels which trade up and down the west coast among the lochs and islands where, in the aggregate, there is a considerable population dependent mainly, if not, in many instances, exclusively, on sea communications for the supply of their requirements; but the capacity of the waterway is so limited, the locks through which vessels must pass are so numerous, and the time taken in getting through the canal—especially if there are delays at Ardrishaig, on account of the tide—is so unduly long, that the waterway is a restriction on rather than any real aid to the said communications, with the result that the local populations suffer a real hardship, and a serious restriction is put upon the development of the districts in which they live.

What is wanted more than anything else, not alone to encourage the development of the Western Highlands but to check its further depopulation, is improved transport—and by this, in the present instance, is meant improved sea transport. It is a question, socially, of giving relief to a feeling of comparative isolation; economically, of encouraging settlement, trade and industries by bringing producers, markets and consumers into closer touch the one with the other, and, nationally, of furthering the development of the natural resources of the west coast of Scotland and of the Highlands to the advantage, not alone of the districts immediately concerned, but of the country in general.

All these considerations apply with especial force at a time when every practicable means likely to assist in the building up of the nation afresh after the experiences of the last few years should call for attention. There is, too, the greater reason why such course should be adopted in the case of the Crinan Canal since this particular scheme is one that is essentially "ripe for development." Surveys, plans and estimates are all in readiness—subject to a necessary revision of the last-mentioned; there has been no alternative route since the one via Loch Tarbert was ruled out, and various complicated questions which would necessarily have to be decided before a start could be made with either an enlarged Caledonian Canal or a Forth and Clyde Ship Canal do not arise in regard to a Crinan Ship Canal. The cost, also, would be far less than that certain to be involved in the case of either of the others, and the traffic prospects are so favourable—especially if those in regard to water-power development in the Highlands should be realized—that the new waterway, adapted to all modern requirements, should soon be no less self-supporting than, in spite of all its imperfections and shortcomings, the existing canal was from 1860 down to the outbreak of war.

We have seen that so far back as 1909 the Royal Commission on Canals and Waterways expressed the view that "a strong case" had been made out for an improved Crinan Canal; but the case is much stronger to-day if only because the needs alike of the Highlands and of the nation are greater and the outlook for the eventual success of the

scheme itself is more favourable ; though in regard to matters of finance it will be indispensable that the Government should take the " broad view " of the Rural Transport (Scotland) Committee, endorsed by the Ministry of Transport Crinan Canal Committee, to the effect that " there is a national duty to provide every community with reasonably convenient means of communication," rather than the narrow view of the Treasury in 1911, when they said in regard to the Crinan Canal scheme that it was " a matter of purely local concern."

Whether or not there would be any direct return on the comparatively small expenditure incurred—small, that is, when compared with what would be involved in the building of the " Direct Route " Forth and Clyde Sea-level Ship Canal—is a detail one should not allow to weigh against the consideration that such expenditure would be an investment in a policy of national reconstruction which should especially aim at industrial expansion, economic advancement and the social progress of communities hampered and handicapped by defective communications.

STATE OWNERSHIP.

It is conceivable that if the Caledonian and the Crinan Canals had belonged to private companies who had allowed them, after so many years, to remain still unfinished and to get into the condition they were in before the last series of makeshift repairs was carried out on them, they would have been pointed to by persons of Socialist tendencies as object lessons of the evils of private enterprise, and as strengthening to a pre-eminent degree the agitation still being raised from time to time in favour of the transfer of canals in general to State ownership.

As it is, we get object lessons from the other point of view—that, namely, as to what might happen in this country if the State should ever own and operate all public utilities on its own account.

Colonel E. D. Malcolm's reference to " the Government's disinclination to accept the responsibilities of ownership," in his letter of June, 1917, from which some extracts are given on p. 76, sums up in a few words what has been the main characteristic of the Government ownership alike of the Crinan (to which he specially alluded) and the Caledonian throughout. The most remarkable instance of the said disinclination was, of course, that which occurred in 1860, when the Government of the day, weary of the trouble, the worry and the expense in which the two canals had involved them, offered a ninety-nine years' lease of either or both of them, rent free, to any private capitalists disposed to relieve them of the burden—and, incidentally, themselves incur the heavy expenditure which would be involved in completing the work in each instance. The Caledonian Canal Commissioners—who were no more than an administrative and advisory body acting for successive Governments none of whose members, possibly, had any practical knowledge of canal construction, upkeep or management—may well have declared, as the result of the difficulties they had experienced in securing even such funds as were necessary for urgent repairs, " They

are persuaded that the management of such an undertaking would more properly be entrusted to the enterprise of public capitalists."

It has been shown, also, how, even so recently as March, 1921, a Ministry of Transport Committee could be invited to inquire and report, among other things, whether the Crinan Canal should be allowed to become derelict—an expedient which would, indeed, have allowed the State to relieve itself effectively of the responsibilities of ownership, though one that would have meant little short of disaster to the communities the waterway still serves.

That private enterprise should have had to abandon the attempt to complete and carry on the Crinan Canal after making so brave, patriotic and costly an effort—in the interests of public advantage rather than of private gain—was in no way any reflection upon those concerned; but, apart from this incident, the facts narrated in the present volume may be regarded as offering a striking contrast between State and company management in respect to the waterways in question.

On the one hand we find that, although the State has owned the Caledonian Canal for a century, and been absolute owner of the Crinan for half a century, it has done nothing either to enlarge or to modernize either of them. Apart from just about sufficient repairs to prevent them from collapsing, it has done practically nothing in the way of carrying out improvements which would increase the capacity of either waterway. The only instance, also, which can be recalled of any action taken under their authority in the offering of additional facilities for the handling of traffic occurred in 1847, when, on the recommendation of Mr. James Walker, C.E., a fleet of four steam-tugs was put on the Caledonian Canal to enable sailing vessels to overcome the effects of adverse winds.

On the other hand we have the story of the enterprise shown by the original Company of Proprietors of the Forth and Clyde Navigation in the development of passenger traffic (an example afterwards followed by the Edinburgh and Glasgow Union Canal Company); in the experiments made by them with a view to the introduction of mechanical haulage, and in the success they attained as regarded the application of steam power, for the purposes of propulsion, to the canal-vessels themselves. The Company of Proprietors of the Monkland Canal were, also, unwearied in their efforts to introduce quite a number of improvements and innovations with a view to increasing the efficiency of their undertaking. Nor were the railway companies who followed these independent companies in the ownership of the canals in question any less persistent in their aim to secure a maximum of possible traffic by the offering of greater transport facilities, and in other ways.

Certain it is that the Forth and Clyde Navigation, the Monkland Canal and the Edinburgh and Glasgow Union Canal will to-day stand comparison in every respect with the State-owned Caledonian and Crinan Canals; and any one who wishes to gain support for views he may entertain in favour of nationalizing British canals and waterways in

general, on the assumption that State management is likely to be more efficient than company management, may be warned against going to Scotland for his examples !

OWNERSHIP BY RAILWAY COMPANIES.

In the case of all three of the railway-owned canals in Scotland—the Forth and Clyde Navigation, the Monkland and the Edinburgh and Glasgow Union—there has admittedly been a substantial decline in traffic ; but the facts here presented should satisfy any unprejudiced person that this decline has not been attributable to any fault on the part of the companies concerned. In each instance the decline had set in before the canal came under the control of the railway company, and there is no ground for suggesting that any one of the canals was acquired in order that the railway company which got possession could hasten that decline.

There is, on the contrary, convincing proof that when the Caledonian Railway Company took over the Forth and Clyde Navigation and the Monkland Canal as an indispensable condition to their acquiring the Grangemouth Docks (which were what they really wanted), it was to their direct interest to secure for those canals traffic that would otherwise have been carried by their competitors, the North British Railway Company. Nor can there be the slightest doubt that the Caledonian have done their best to maintain the two waterways in thoroughly efficient condition. In regard to the Edinburgh and Glasgow Union, the North British simply took over the canal as part of the property of an earlier railway company whose undertaking it amalgamated with its own system ; and here again efforts were made, by means of reduced rates and otherwise, to obtain as much traffic for the canal as there was any hope of securing.

If in the competition between canals and railways it was the latter which scored the victory, the reason therefor was attributable to the preference shown by the traders for the railways as the form of transport which they found to offer them the greater advantage. Their works might be, and were, in very many instances, either directly on or quite near to the canals ; yet they themselves sought for rail connections either in addition or alternatively, and this they did because the railways afforded them more convenient terminal arrangements, a wider range of markets from which to obtain coal or other supplies, and better facilities for the distribution of their manufactures. It was a case where a perfectly fair fight was fought between the railways and the waterways, and the eventual result offered one more example of the survival of the fittest.

When we come to the question as to the future of these Scottish railway-owned canals, we have the satisfaction of finding that here, at least, there are no complicated schemes for their reconstruction or substitution with which we need concern ourselves ; and this is something to be thankful for. The Forth and Clyde Navigation is, for physical

reasons, beyond all possible scope of conversion into a ship canal, and nobody proposes any enlargement either of the Monkland or of the Edinburgh and Glasgow Union Canal. In the case of the latter the improvements already being carried out in Edinburgh by the filling up of the two "ports" and the construction of a new terminal basin provide for the only changes which have yet been suggested.

Year by year the three canals receive a steadily diminishing amount of patronage and appear to be less and less required by the trading community; and it would really seem as though, in connection alike with these and with other British railway-owned canals which are having like experiences, the time must one day come when the question will arise whether the statutory obligations devolving upon railway companies to maintain, not alone those of their canals which really are rendering good service, but those, also, which have outlived their usefulness, should still be enforced, or whether the cost of upkeep and management in regard to the latter canals—which item must needs be made good at the expense or to the disadvantage of railway users or railway shareholders—could not, together with the land occupied, be more usefully employed in some other direction.

Meanwhile, and having regard to the possibility of these matters arising for discussion at some future date, it is of interest to note that while the said obligations are still imposed on railway companies to compel them to maintain their canals regardless of the amount of traffic they may—or may not—carry, the State does not hesitate to suggest the abandonment of its own canals and the allowing of them to become derelict, not because these have ceased to serve a useful purpose—the advantages offered both by the Caledonian and by the Crinan within the scope of their limited and antiquated facilities are beyond all question—but simply because the adoption of such a course would be more convenient, less troublesome, and financially preferable to a Government which, in regard to State-owned canals and waterways, at least, may have grown weary of "the responsibilities of ownership."

The precedent thus established is one that may, at least, be borne in mind concerning other canals to which the suggestions advanced might be much more suitably applied.

THE FORTH AND CLYDE SHIP CANAL SCHEMES.

In summing up the situation in regard to the proposed Forth and Clyde Ship Canal, the predominant factor is the absolute hopelessness of the so-called "Direct Route" Sea-level Ship Canal project, whether regarded from a strategical, a commercial or a practical point of view.

Strategically, the case put forward in support of the "Direct Route" scheme is based on two grounds, (1) that a navigable waterway of the type proposed would facilitate naval concentration in either the North Sea or the Atlantic, and (2) that, serving as "a back-door to Rosyth," it would be a means whereby ships damaged in the North Sea could

speedily pass to the shipbuilding or repairing yards on the Clyde or elsewhere on the west coast.

The question of naval concentration is naturally one as to which the naval authorities are the most competent to offer an opinion ; and it might be assumed that, if these gentlemen had any really strong views as to the national importance of the canal for the serving of this purpose, they would show a little more zeal in supporting the project, and not leave the advocacy of it quite so much in the hands of amateur strategists in the city of Glasgow.

REPAIR OF DAMAGED WARSHIPS.

On the other branch of this particular subject, it is more competent for the average person to form a judgment of his own ; and one does not need to be a naval expert to doubt the expediency of sending damaged warships from the North Sea to the entrance of the ship canal up the Firth of Forth, thence through a narrow canal to its junction with the River Clyde, and so on to the yards situate thereon, when it might or should be possible to have the repairs effected equally well, and with much less risk, on the east coast. The adoption of the former course would certainly foreshadow the possibility of the damaged ship coming to grief either in the Firth of Forth, in the canal, or on the Clyde. If it sank in or otherwise blocked the canal—an eventuality quite possible if it came into contact with other shipping—the result might be a more or less prolonged stoppage, not alone of ordinary commercial traffic, but, in war-time, of that very “naval concentration in the North Sea or the Atlantic” which would constitute the other main purpose of the canal from a strategical standpoint.

Assuming that the damaged warship did reach the Clyde safely, it would not necessarily be in a better position for getting repaired there than if it had remained in the Forth. The reputation of the Clyde as a shipbuilding centre of world-wide fame and importance is incontestable ; but between ship-building and ship-repairing there is a distinction and a very wide difference, so that while the Clyde takes the highest rank in the one direction, the Forth, with its control of a larger extent of dry-dock accommodation, offers the greater advantage in the other. If, also, it became a matter of building more of the dry-docks which are, of course, the first requisite in ship-repairing, it would be far better to provide these on the Firth of Forth, where there is plenty of space available, than in the much more confined area of the Clyde, where the docking or undocking of large vessels may necessitate a stoppage of all other traffic along the river for the time being. A very large amount of war-ship repairing was done at Leith during the war ; and it would certainly appear to be more practical, as well as more economical, to provide there such additional facilities as may be necessary in preference to spending many millions of money on building a canal for the transport of damaged war vessels to the other side of the country for repair under what would seem to be much less favourable conditions.

If a Mid-Scotland Ship Canal were really needed for strategical purposes, the Loch Lomond route would offer many advantages over the "Direct Route," and in the controversies between the rival parties the declaration made in 1909 by the Committee of Imperial Defence, and supported by the Admiralty, to the effect that "The route through Loch Lomond and Loch Long is the only one which satisfies naval requirements," is not to be overlooked; though, having regard to the tendency now prevailing among peace-loving nations to cut down their expenditure on armaments and war preparations generally to the lowest level that prudence will permit, the present would seem to be a most inopportune moment for the advocacy of costly waterway schemes mainly on the ground of their utility for strategical purposes.

THE CANAL ASSOCIATION AND COMMERCIAL POSSIBILITIES.

It must, however, be confessed that advocates of the "Direct Route" allow strategical to become almost a side issue as compared with commercial considerations in their aim to secure support for their own particular project. In one circular issued by them the Canal Association say:—"From a strategical point of view the two routes are about equal, while commercially the Direct Route is infinitely superior"; and it is to the establishment of this infinite superiority and the conversion of unbelievers or the apathetic to a belief in the commercial merits of the route they favour that most of their data, arguments and predictions are devoted. The commercial possibilities of the route are, in fact, described as "boundless." They are more especially regarded as assured by (1) estimates based on Board of Trade shipping statistics and (2) the anticipations entertained as to a great expansion of industries along the banks of the canal in order that advantage may be taken of the proposed new transport facilities.

According to the estimates of the Canal Association, the shipping that would use the canal on account of saving in distance or for other reasons is 14,584,590 net tons, or 23,000,000 gross tons, of shipping, the last-mentioned figure being no less than 19,500,000 gross tons in excess of what the Board of Trade experts had themselves given as a "generous estimate" of the prospective traffic. This difference of opinion has given rise to a correspondence in which the Association have sought to maintain their own conclusions—though without securing the acceptance of them by the Board of Trade.

How remorselessly the Association figures have been criticized by Mr. Malcolm McDonald in the Memorandum prepared by him for the Edinburgh Town Council has already been told; but, assuming for the sake of argument that the Association's statisticians are perfectly right, and that the Board of Trade is hopelessly wrong, certain questions which would then arise are—

1. Would the canal be able to deal with fourteen and a half million net tons of commercial shipping?

2. Would any Admiralty traffic, including the damaged warships, have a chance of getting through as well ?

3. What would happen if one of these warships did come to grief in the canal, and held up all other traffic for some weeks or even for a few months ?

4. Would it be any gain to the country if fourteen and a half million net tons of commercial shipping, passing through the canal, were simply diverted thereto in order that the dues paid might go towards meeting the prodigious cost of cutting the canal, while other ports, which had already spent large sums to accommodate the same traffic, were left to experience a corresponding decline in their own revenue ?

5. Would it not be more in accordance alike with sound commercial principles and with the fundamental need, under existing conditions, for national economy, that Leith and Grangemouth—two most excellent ports and well equipped from every point of view—should be left to continue their rôle as distributors of imports (supplemented by railways communicating with every part of Great Britain, by road services which are ever becoming more active, more numerous and more enterprising in the distances they cover, and, in the case of Grangemouth, by a barge canal equal to practically all requirements in respect to local waterway transport), without the construction of a new and exceptionally costly canal which, so far as those imports are concerned, would simply take them a few miles further inland, with no practical advantage to any one concerned apart from certain interests in the city of Glasgow ?

DEVELOPMENT OF LOCAL INDUSTRIES.

Dealing next with the question as to a prospective great expansion of local industries, it has been claimed with much persistency that, inasmuch as the " Direct Route " Sea-level Ship Canal would pass through a centre of industrial Scotland where coal and iron mines and important works of every description are already to be found, it would help both to develop these existing industries and to draw new ones to the district. The Royal Commission on Canals and Waterways were confidently assured that the large iron works and other undertakings would prefer to put their products on board ship at once instead of sending them by rail to Glasgow or Grangemouth for transshipment, and, in the same way, receive their raw material by ship ; while one witness foreshadowed the possibility of the entire waterway becoming " practically one elongated line of wharves."

The absurdity of this last-mentioned idea became, at first, apparent even to the Mid-Scotland Ship Canal Association itself, the statement being made in a " Memorandum Comparing the Direct Route at Sea Level with Messrs. Sir W. G. Armstrong, Whitworth and Co.'s Loch Lomond Route " that " It has never been suggested to have loading places and wharves all along the twenty-nine miles of the canal. . . . The loading places would be at suitable spots." This circular, in accordance with what would seem to be the practice of the Association, is

undated ; but it must, of course, have been issued subsequent to the early part of December, 1917, when the report referred to in the title was first made public. In a later, and again undated, circular, believed to have been sent out in October, 1919, the Association say of their "Direct Route" scheme :—

The canal would greatly assist in solving the present rail, road and water transport difficulties. At present the railways have much more than they can carry, and are largely occupied in conveying goods to shipping ports. By extending our sea line along twenty-nine miles of a salt water canal with wharfage on each side, and bringing shipping facilities into the very heart of a great industrial district where goods can be shipped at many points, relief would be given to the railways and rapidity of shipping would be increased and cheapened.

The difference between this and what had previously been denied is not material, if one allows for a certain degree of poetic licence in the former instance ; but on one point, at least, there would seem to be a unanimity of opinion on the part of supporters of the "Direct Route" scheme—the expectation, namely, that *because* facilities for dispatching goods and for receiving raw materials by means of a ship canal were provided, *therefore* the traders would hasten to avail themselves of the opportunity, doing so even to the extent of setting up new works or starting fresh industries alongside the canal in order to gain the advantage of the water transport. In the circular (of October, 1919) just referred to, the Canal Association also say :—

Water carriage is cheaper and more convenient for shipping purposes than railway carriage, and so the canal would induce industrial concerns to put down works in its neighbourhood particularly in connection with the coal, iron and oil industries, and iron founding in all its branches. Instead of conveying ore and machinery for several miles to the Clyde docks, these could be loaded at wharves near the works, without transhipment.

TRADERS' PREFERENCES.

People who talk in this strain cannot yet be aware of the experiences of the Forth and Clyde Navigation, the Monkland Canal and the Edinburgh and Glasgow Canal, as detailed in the present volume. All three have been in a position to afford water transport to works situate immediately alongside, and in no instance—so far as the present writer is aware—has any complaint been made of defective upkeep or of absence of adequate facilities ; yet the common experience has been that the traders concerned were not satisfied to rely on water transport because (for the reasons stated) they found rail transport preferable, and appealed to the railway companies to provide them with loop lines and sidings even though they had the canals almost at their very doors, and even although the railway companies, as canal owners, were themselves desirous to get all the water traffic they could.

DEEP CUTTINGS.

If these preferences on the part of traders are found where there is already direct access between works and canal, and where the water-

transport conditions in general are normal, what is going to happen in the case even of a ship-canal the water level of which would, for a distance of over twenty miles of its total length, be between 100 ft. and 120 ft. below the surface of the land alongside? Is it likely that traders who will not use one canal when it is practically on the same level as their works are going to use another situate at this depth below them?

The Canal Association affects to regard this question of deep cuttings as a matter of no importance, so far as the traders are concerned. The circular in which it is stated that the loading places would be "at suitable spots" goes on to say:—"For the rest it would not matter how deep was the cutting. The deepest cuttings on the Direct Route are at parts where loading places would not be necessary or desirable, and high banks can always be overcome by roadways cut through at a suitable level." The deepest cuttings would be 120 ft. in depth; but, even if these were left out of consideration, there would still be twenty miles or more of canal at a depth of 100 ft. which would come into consideration; and, even supposing that banks of this height could be overcome by the cutting through them of roadways leading down to the "loading places at suitable spots," those concerned would naturally want to know, in the first instance, at whose expense this cutting of access roads and this construction of loading places was to be done. Would the work count as part of the cost of making the canal, or would the trading firms, collectively or individually, be expected to pay the bill themselves? In the latter event, is it likely that there would be any gain or advantage for the traders in their adoption of this method of transport as compared with the dispatch or the receipt of their consignments by rail, especially considering that, as all Scottish experience shows, they would still *want* to have rail transport facilities, however convenient—or inconvenient—the available water transport might be?

TERMINAL FACILITIES.

Apart from these financial questions there would remain that other question of terminal facilities which constitutes one of the main issues as between canal traffic and railway traffic in general. If traders whose works are situate at a height above the canal of 100 ft. or more are first to load up their goods so that these may be sent down a roadway—at, probably, a fairly steep incline—by means of some mechanical appliances or otherwise, to the water level, there to be transferred to the vessel awaiting them, would it not be found more convenient and less expensive to put the goods at once on railway trucks standing on rails laid right into the works and connecting with main lines of railway by which the consignments could be taken direct, without transhipment, to any part of Great Britain?

It may be replied that, while there is force in this suggestion as regards consignments for inland delivery, the position would be different in the case, say, of imports brought to Scotland by ocean-going steamers.

If the vessel had a full cargo for delivery at some one destination either on the canal or at the other end thereof, it might be worth while for the vessel to go there; but much of the inwards traffic already transhipped at Leith or Grangemouth consists of individual consignments not exceeding, say, 50 tons in weight, and, as these can be sent on by barge or train, it would surely be bad business from a shipping point of view if an ocean-going steamer had to spend its time in going along a canal to deliver 50 tons or less at one spot, a few more tons at another wayside wharf, and so on until it had got rid of its cargo, just as if it were a sort of parcels-delivery van on water. Like considerations would apply to export traffic.

The conclusion is thus forced upon one that the prospects of local traffic on a Mid-Scotland Ship Canal would be even less favourable than those of sea-to-sea traffic. Already the former is an ever-diminishing quantity on the Forth and Clyde Navigation, the falling off therein being at an even more accelerated speed than in the case of sea-to-sea traffic; and it stands to reason that in any competition between the existing canal and the new one, in respect to such local traffic as that with which it could deal, the former would be the more likely to get the business because it could afford to charge a lower scale of rates than a ship canal on which so vast an outlay had been incurred.

THE QUESTION OF PRACTICABILITY.

Looking now at the "Direct Route" scheme from the point of view of practicability, one must first consider what—apart from the exact extent or nature of the use that might be made of it—the undertaking would be likely to cost.

It has been seen (p. 219) that the Armstrong-Whitworth estimates for a sea-level, as distinct from a fresh-water canal, by the said route amount to, in round figures, £57,500,000. But this already huge figure makes no allowance for the provision of wharves, concerning which, the firm state in their report:—

The provision of wharves along the route of the canal would necessarily be an expensive matter, because for the greater part of its length, wherever these were placed, very heavy cost would be incurred in excavation to afford the requisite additional width required in consequence of the depth of the cutting. Then the requisite connection between the wharves and the natural surface of the ground for transport of goods, whether made by railway or by some mechanical means, would add seriously to the cost for the same reason. This point can best be illustrated by the fact that the relative cost of an acre of dock and wharf space as between a site on the banks of the canal and one on the banks of the river Clyde would be in the ratio of about 3 or 4 to 1 in favour of the Clyde.

Then for the greater part of its distance the canal would overlie strata containing coal, fire-clay, iron-stone and other valuable minerals in which the district passed through is rich; and whilst, on the one hand, the supporters of the "Direct Route" point to this very fact as one of the main arguments in its favour, the Armstrong-Whitworth report says there would be—

A serious addition to the primary expense of the undertaking on account of the heavy charges which will necessarily arise not only for mineral compensation but for the work which would probably be necessary to secure the stability of the canal in view of the disturbance of the underlying strata by the working out of the minerals. Indeed the risk and uncertainty as to the safety of the canal in the present project owing to the presence of such a great extent of mineral workings is necessarily inherent in the conditions of the present case, and in this respect we entertain less certainty as to the result as compared with our original project.¹

What the additional expenditure in these respects would be likely to amount to cannot be estimated at present ; but this further cost would have to be added to the figures already mentioned.

There is, also, much more in these questions as to mineral workings than even the engineers in question had in view.

The fact will be recalled that, in the evidence he gave before the Royal Commission on Canals and Waterways (see p. 206), the late Mr. R. Millar said that a good deal of the water collected by the Caledonian Railway Company for the Forth and Clyde Navigation was lost by reason of leakage due to the underground workings in the district through which the water was conveyed from the reservoirs to the canal. Such leakage as that here in question was, of course, in respect to water flowing along the surface of the land, at a good elevation ; but for a distance of twenty miles the total depth of the cutting for the " Direct Route " canal, practically alongside the other, would be at least 145 ft. (allowing 45 ft. for the canal itself and 100 ft. for the depth of the cutting above water level) ; and coalowners having mines along or adjoining the route may well ask themselves—as, indeed, they are—whether there is not a prospect, and a very grave prospect, of their workings being flooded out by the leakage into them of water from a sea-level canal the bottom of which would be all those 145 ft. nearer to the said workings than the streams of water required for the feeding of a barge canal at the much higher elevation.

The loss of the water might not be a matter of much concern to the " Direct Route " canal, which would be able to draw on the sea for fresh supplies ; but the Scottish coalowners do not want to have the sea pouring into their mines, and, if it should—as, according to what Mr. Cadell said at the meeting of the British Association at Edinburgh, they suspect it may, if the canal is ever constructed—the item of compensation to the mining interests will, indeed, be a serious one for those who become responsible for the canal to face.

Nor do the estimates for the " Direct Route " canal allow for what the engineers think will be the " very large " cost of acquiring the land, together with the shipyards and other property standing thereon, which would be necessary in order to *afford access* for the canal to the river Clyde ; or, again, for the tidal basin and range of shipping docks which the Canal Association proposes should be constructed on the canal itself at a point adjacent to the northern boundary of the city of Glasgow—

¹ By the words " our original project " is meant the report made by the firm, in the first instance, on the Loch Lomond route scheme.

in a situation and under conditions which, one may suggest, would alone involve a very heavy outlay.

Keeping in view all the items which are either actually proposed or may be more or less foreseen, and leaving out of account the inevitable further items to be classed as unforeseen, this "Direct Route" Sea-level Forth and Clyde Ship Canal would seem to open up for the country the prospect of a bottomless pit of expenditure for the greater part of which the British taxpayer would, directly or indirectly, have the financial responsibility.

THE INTERESTS OF GLASGOW.

No undertaking having any approach in magnitude to the one here in question ought, surely, to be brought forward for consideration without the support of much more definite evidence as to its prospects than has yet been forthcoming as a reason for the selection of the "Direct Route"—should a canal for strategical purposes be really necessary—in preference to what might almost be called the "Original Route." The estimates of commercial traffic have thus far been based on little more than pure assumption. There is no proof whatever that the canal has been asked for by shipowners, coalowners, manufacturers or traders in general, that it is desired by them, or that it would be used by them to any material extent should it be constructed. If these classes were eager to get the canal, they might have been expected to give a greater degree of practical support to the movement, and the difficulty which arose in the raising of a few thousand pounds to defray the cost of preliminary surveys would have been avoided.

What the "Direct Route" canal is really wanted for is to ensure the promotion of Glasgow interests; and here we come face to face with the fact that from the time when the project for a Mid-Scotland Ship Canal first began to assume a practical form, over a century ago, to present date, the attitude shown thereto by *citizens* of Glasgow—who, however, have not necessarily represented, officially or unofficially, the *City* of Glasgow—has been mainly and consistently inspired by regard for Glasgow's own welfare.

A brief recapitulation of the matters of history already narrated in this connection should suffice to show that the statement here made is based on good authority.

The very first proposal of all, that, namely, of Charles II, was for a canal connecting the two firths which would enable "transports and small ships of war" to cross Scotland from sea to sea—thus serving an essentially national purpose. The same idea inspired Defoe, led to the earliest surveys, and formed the basis of those carried out by Smeaton.

It was these strictly national considerations which, in turn, influenced the patriotic and far-seeing men of Edinburgh and its neighbourhood in proposing the construction of a sea-to-sea canal for which estimates should be prepared for various depths up to 14 ft., Smeaton being instructed accordingly.

From Glasgow and the Carron, however, came the cry of merchants or manufacturers that there was no need whatever for the canal to go further west than Glasgow, or that it should have a greater depth than 4 ft.—constituting what the Edinburgh party spoke of contemptuously as a “4-ft. ditch.” The opposition thus offered was so far effectual that, as the result of a compromise, the canal first had a depth of 7 ft.; but this had to be increased on two successive occasions, the assertions of the Glasgow-Carron traders as regards depth being thus completely nullified. We have seen, also, that when, owing to lack of funds, construction had to be stopped on the canal being brought within three miles of Glasgow, that city raised the money for a branch to Hamilton Hill; but twelve years elapsed before the main line of the canal could be completed and the sea-to-sea connection secured.

When, later on, it was found that the barge canal thus made was not adapted to conversion into a ship canal, and an important syndicate instructed Messrs. D. and T. Stevenson, of Edinburgh (in 1889), to make detailed surveys, borings and plans with a view to their seeking Parliamentary powers to construct such a canal, the preference of the engineers for the Loch Lomond route led to the starting in Glasgow of a National Ship Canal League which initiated a counter movement for a canal by the Glasgow route, and foreshadowed so keen an opposition to the Loch Lomond scheme that the promoters of the latter at that date abandoned their idea. It is thus conceivable that a Mid-Scotland Ship Canal might have been provided years ago, and been available for naval purposes in the late war, but for the action taken in Glasgow.

Vice-Admiral Sir Charles Campbell, influenced by purely patriotic motives, was, at the end of 1907, firmly convinced that the Loch Lomond route was the only one practicable; but, on finding that it would be hopeless to get a canal built by that route in face of lack of support by, and the active opposition of, Glasgow, he was led to give in his adhesion to the “Direct Route” party. Before long the association he had formed in London on national lines was practically superseded by a Glasgow and West of Scotland organization the main purpose of which would seem to be to convince the Government and the country that “the prosperity of Glasgow, the Clyde and the West of Scotland are vitally concerned” in the choice of the “Direct Route,” and that the selection of the Loch Lomond route—no matter, apparently, what may be said in its favour from a national or a practical point of view—would be “Glasgow’s Danger!”

No one would wish to do any harm to the interests of so great and important a city as the commercial capital of Scotland; but the construction, at the risk, if not at the actual cost, of the nation, of a “Direct Route” Ship Canal designed to serve what should primarily be national purposes is a matter which must necessarily be looked at and decided upon from the point of view of national rather than of local considerations—and more especially so when the case put forward in support of those local claims is based on assertions so vague, involves the prospect of

financial liabilities so gigantic, and foreshadows prejudice so serious to other communities and other interests, that it is inconceivable Parliament will ever be induced to sanction so dubious an adventure.

THE LOCH LOMOND ROUTE SCHEME.

The view just stated is held by the writer with the greater conviction because, if the need should arise for the construction, as a matter of imperative importance from the point of national defence, of a Mid-Scotland Ship Canal linking up the Forth and the Clyde under conditions which could not be adequately served by a reconstructed Caledonian Canal, there would still be the Loch Lomond route proposal to fall back upon.

Although kept in the background of late years on account of the more persistent advocacy of its rival, there can be no doubt that in various respects the Loch Lomond Route would offer distinct advantages over the other route. In the event of any further national emergency in which it became expedient for warships to pass between the Firths of Forth and Clyde under the best conditions as regarded safety and avoidance of detention, they would do so much more readily by way of Loch Lomond than if they had to go along the "Direct Route," with its wharves on either side, and make their way into and along the River Clyde. The stopping, too, of all other traffic for the greater safety of the warships would be a matter of no great inconvenience in the case of the Loch Lomond route, though it would be almost disastrous if the commercial shipping on the Clyde were held up "for the duration of the war," more or less, to say nothing of that fourteen and a half million net tons of commercial shipping which the Canal Association expects to pass regularly along the "Direct Route" canal itself.

Then there have been suggestions that a veritable arsenal could be set up at some point or other on the "Direct Route" and that this would be of great advantage to H.M. Navy; but, if anything of this sort were necessary, it would, surely, be preferable to utilize for the purpose the much better accommodation to be found on Loch Lomond. On the Loch Lomond route, also, there would be freedom from those anxieties which are bound to arise on the "Direct Route" on account of colliery workings. The passage via Loch Lomond would, geographically, be the longer of the two; but this would be a matter of no great consequence, the more so as a vessel could steam across Loch Lomond and down Loch Long at a greater speed than would be practicable in going either through the artificial cutting of the "Direct Route" or along the river Clyde. There would, further, be less risk of detention on account of accident or interruption of traffic from one or other of the various causes that might arise on the "Direct Route" in connection with the wharves and the merchant shipping, though the question might, and probably would, arise, as to whether the summit water supply (otherwise, the Loch Lomond watershed) would suffice for a paying traffic, assuming that the locks provided were of battleship dimensions.

The one great argument against the Loch Lomond route and in favour of its rival has been found in the expectation that the latter would secure a far larger amount of commercial traffic, thus offering greater advantages and being in a better position to pay its way. The commercial patronage of even a "Direct Route" canal would, however, be a very doubtful quantity and an insufficient justification for incurring the far greater cost the selection of this route would involve, not alone as already provided for in the estimates, but, also, to cover the extras and the contingencies for which the estimates have not provided. If the charges imposed on shipping likely to use the canal were on a scale commensurate with capital outlay, cost of maintenance, management, and unforeseen liabilities, coupled with the expenses to which the traders along the canal might be put in the transport of their goods between works and water, it is practically certain that the commercial traffic would never assume other than very small proportions indeed.

Nor is there much reason to expect that, apart from whatever might be done through the development of water power, new industries would be started along the Loch Lomond route in order to take advantage of the water transport facilities. In the Armstrong-Whitworth report on this route it is said :—

While the revenue to be derived from the use of the canal by commercial vessels will no doubt yield sufficient to cover the cost of upkeep and working expenses besides providing a considerable contribution towards the annual charges for interest upon the cost of the work, we do not for a moment imagine that such a work as we are now proposing can be carried out as a profitable commercial scheme ; indeed we greatly doubt whether any canal across Central Scotland, even if carried out upon restricted dimensions suitable for commercial vessels only, would be a profitable undertaking under normal circumstances for many years. The project we are now proposing can only be justified by the great strategic purposes which we understand it will serve, and as to which, of course, we do not venture to express an opinion. We think it worth while to point out, however, that the advantages other than strategic which the nation would derive from the construction of this work would be very great, especially in the direction of the development of trade and commerce.

Here, again, we get only surmise or expectation, and engineers may not be so well qualified to give an opinion on shipping and commercial questions as shipowners and traders ; but the material consideration to be kept in view is that, if the commercial outlook for the "Direct Route" canal is so doubtful, and if the possible revenue therefrom were nullified—as it might conceivably be—by the greater cost of building the canal by that route, plus the extras, etc., then the *commercial* prospects of the two routes would be approximately equal, and the real basis of comparison between them would lie in their respective strategic advantages.

In this case judgment would assuredly have to be given in favour of the Loch Lomond route.

Except by those belonging to or coming under the influence of Glasgow, the Loch Lomond route has all along been regarded as the better of the two. It was favoured by such unprejudiced persons as the Duke of Sutherland, Lord Strathcona, Sir John Jackson and the various groups

of financiers who were associated with Messrs. Stevenson. It was the one which commended itself to the organizers of the original London association for promoting the construction of a Mid-Scotland Ship Canal to serve strategical purposes. The Committee of Imperial Defence, whose view was endorsed alike by the Admiralty and the Royal Commission on Canals and Waterways, declared that this was the only route which satisfied naval requirements. In a later pronouncement, made public by the Mid-Scotland Ship Canal Association, the Admiralty, while still of opinion that the Loch Lomond route had, from a naval aspect, many advantages over the "Direct Route," realized that the latter was "the only one which might possibly be a commercial success"; but if this possibility of commercial success should be without reasonable hope of fulfilment, Admiralty support of the "Direct Route" would no longer have any foundation.

As against, also, the view thus taken by the Admiralty, there is to be put an assertion made by the secretary of the Canal Association in a letter to the Edinburgh Corporation replying to an invitation addressed to them for their observations on Mr. McDonald's Memorandum. Referring to that gentleman's severe criticism of the figures which had been put forward as to the extent of the commercial patronage the canal was likely to receive, the secretary said:—"We have never suggested that it would pay its way, at least for many years. . . . The keynote of the Memorandum is that the canal 'would not pay.' This we believe to be correct, and have always stated it as our opinion regarding the canal's first twenty years." Such an admission certainly weakens the force of the Admiralty suggestion that the "Direct Route" might, possibly, be "a commercial success"; though by this time the Parliamentary Under-Secretary for Health (Scotland) had already made his announcement in the House of Commons that, in the opinion of the Admiralty, the strategical advantages of the canal were not of sufficient importance to justify the Government in incurring "at the present time" the expenditure which would be involved.

The prospect of the Government undertaking the construction of a Mid-Scotland Ship Canal at all for the attainment of strategical advantages must to-day be looked upon as problematical in the extreme; and as to the expediency or otherwise of adopting any such course it is not the purpose of the present writer here to offer any opinion. His only aim, in this connection, is to compare the respective merits of the two routes in the event of the main question being revived at some future period; and on this he submits that, inasmuch as the leaders of the Canal Association have failed to make out their case in regard to the commercial use likely to be made of a "Direct Route" canal, the chief argument in favour of their own project as against the other is no longer tenable, and the Loch Lomond scheme, with its admittedly superior advantages from a naval standpoint, must, therefore, now be regarded as having the superior claim to public attention.

CHAPTER XVIII.

CONCLUSIONS.

THE conclusions to which a study of the various subjects here dealt with have led the writer as the basis of a definite inland waterway policy for Scotland may be stated thus:—

The proposed Crinan Ship Canal comes first in its claims on public attention at the present time as a project which, at a comparatively small expenditure (the pre-war estimate of the cost of carrying out the plans already prepared being only £796,000, as against the £57,500,000, plus extras, required for the "Direct Route" Forth and Clyde Sea-level Ship Canal), would render an invaluable service to the Western Highlands and Islands by (1) effecting a much-needed improvement in their communications with the Clyde and elsewhere; (2) encouraging the expansion of fisheries and—especially in connection with water-power schemes—other industries; (3) leading to the settlement of new communities along the line of route between the Clyde and Oban, and (4) promoting the social and economic welfare of districts where the need of development by means of improved transport conditions is more pressing than in, perhaps, any other part of Great Britain.

A reconstruction of the Caledonian Canal is of less importance and urgency from the point of view either of Scottish interests or of sea-to-sea communications; but the antiquated waterway, not properly constructed at the outset, and never put into satisfactory condition since, will require considerable additional expenditure at an early date in the way either of repairs or of ensuring its safety in case of abandonment; and, having regard to this inevitable outlay, the question arises whether, instead of giving merely a fresh lease of life to what is out-of-date and inefficient, it would not be better to effect a general improvement by bringing down the present summit level to either the Loch Ness or a lowered Loch Lochy level, enlarging the waterway, and reducing the number of locks, thus enabling larger vessels to pass through from sea-to-sea in shorter time than at present, and

conferring advantages alike on H.M. Navy, on the mercantile marine and on local industries.

The railway-owned barge canals of Scotland afford especially striking evidence as to the reason why, in spite of all that has been done to secure for those waterways as much traffic as possible, the traders have transferred more and more of their business to the railways because of their preference for the much greater facilities the latter afford, and especially so when they can secure the construction of branch lines and sidings coming right into works which, situate on the banks of the canals or in the immediate proximity thereof, occupy an apparently ideal situation for taking advantage of the canal transport now, in effect, but little used.

No occasion has arisen for new works upon these barge canals apart from the improvement scheme already being carried out by the North British Railway Company under an arrangement with the Edinburgh Corporation at the eastern terminus of the Edinburgh and Glasgow Union Canal within the precincts of that city, and the future of the three canals themselves is, apparently, a question which must stand over until the time comes—as it may be expected to do, sooner or later—when practical men will ask whether the expenditure incurred on and the land occupied by canals which railway companies are under statutory obligations to maintain, notwithstanding that many of those in Great Britain generally seem to be very little wanted, if at all, could not be devoted to a more useful and more remunerative purpose.

If, at some future time, it should become imperatively necessary, for purposes of national defence, that a Mid-Scotland Ship Canal between the Forth and the Clyde should be constructed, the nation must be prepared to make such sacrifice as would be involved in the provision thereof by the route best adapted to ensure the realization of the one great purpose in view, without the complications and the disadvantages that might result from undue regard either for a commercial traffic not to be definitely assured or for the local interests of any particular city, port, place or district which, in a national scheme affecting, even commercially, a wide area, would have no just claim to special consideration over any other.

The finding of employment for the unemployed has been persistently put forward by advocates of the Direct Route as one of the main reasons for the carrying out of that undertaking; but, apart from the fact that a vast proportion of the unemployed, and especially those of the artisan, clerical, professional, and many other classes, would be unsuited

to the labours of canal construction, there remains the consideration that, as against, for example, the manufacture of commodities for sale or exchange on the markets of the world, benefiting the industries and the commerce of the nation as a whole, the expenditure of millions of money on the said canal would not alone be of immediate benefit to the workers only, in the way of amplification of the "dole" system, but, as shown by the example of the Caledonian Canal, would result in an engineering construction which, incapable, except at prodigious cost, of being restored to former conditions in case it should fail to answer expectations, might involve the country in further heavy expenditure on repairs, maintenance and the assurance of public security and convenience for practically all future time.

Meanwhile the uncertainty as to commercial traffic on the proposed "Direct Route" canal being obtained in sufficient volume to compensate alike for the greater cost of construction, the inevitably substantial extras, and the various prospective risks and disadvantages, leads to that route being, from a commercial point of view, reduced to a position of approximate equality with the Loch Lomond route, and, consequently, deprived of what has hitherto been regarded as the one great point in its favour as against its rival; so that, inasmuch as the Committee of Imperial Defence and the Admiralty have both declared the Loch Lomond route the better of the two as far as *naval* purposes are concerned, it is the Loch Lomond route which should now be adopted in the event of a Mid-Scotland Ship Canal being made at all.

Instead of merely announcing, as they have done on various occasions, that they are not prepared to do anything "at the present time" in reference to a Mid-Scotland Ship Canal, the Government should make a definite statement of their policy, show that they have the courage of what would appear to be their convictions as regards the inexpediency of the "Direct Route" scheme—to which the questions put to them in Parliament invariably apply—and, in saying that they have definitely decided against either that or, it may be, both of the Forth and Clyde schemes, afford a better prospect for the reconstruction proposed for the Crinan and the Caledonian, the work in respect to these being carried out when the national finances may permit, though, what is especially desirable, before there is any further substantial expenditure on what would be merely makeshift repairs, with no increase of present facilities.

Provided this were done, it is possible that an enlarged Caledonian

Canal and the making of adequate provision either at Leith or elsewhere on the east coast for the repair of warships damaged in the North Sea would, in combination, avoid all necessity for the building of a Forth and Clyde Canal at what must needs be an enormous cost under any conditions, and whichever of the rival routes should be adopted.

APPENDIX.

OPENING OF THE CALEDONIAN CANAL IN 1822.

The following account of the opening of the Caledonian Canal in 1822, referred to on p. 16, is taken from a pamphlet in which it was reproduced, at the time, from the *Inverness Courier* of October 31, 1822 :—

Wednesday 23rd October.

WE briefly noticed last week, that Mr. CHARLES GRANT, senior, (late member of Parliament for this county, and one of the Commissioners of the Caledonian Canal,) had of himself, and on the part of the other Commissioners, formally opened this interesting navigation, by sailing from the East to the West shores of Scotland, through the Canal and the chain of lakes which it connects. On this memorable occasion Mr. GRANT was attended by a number of proprietors and gentlemen locally connected with the Canal, the Magistrates of Inverness, and some of the gentlemen of Ross-shire, personal friends of the Commissioner. The number of the party was, by the want of accommodation, necessarily limited to those gentlemen who had their residence in the vicinity of the line of the Canal, or who were otherwise connected with it. A revenue cutter which had been expected was unable to get forward in time, and the small steam yacht, which plies on Loch-Ness, was the only means of conveyance afforded to the party. She was followed, however, by the *Caledonia*, a sloop belonging to the Commissioners.

The number of years which this stupendous work has occupied, the vast Sums which the munificence of Parliament has expended upon it, and the hopes entertained of the benefits it is calculated to confer on this district, and upon the Empire at large, have made its successful termination a subject of general congratulation, and of greater public interest than any local event which we can remember. The doubters, the grumblers, the prophets, and the sneerers, were all to be put to silence, or to shame ; for the 24th of October was at length to witness the Western joined to the Eastern Sea. Amid the hearty cheers of the crowd of Spectators assembled to witness the embarkation, and a salute from all the guns that could be mustered, the Voyagers departed from the Muirtown Locks at 11 o'clock on Wednesday, with fine weather and in high spirits. In their progress through this beautiful Navigation they were joined from time to time by the Proprietors on both sides of the lakes ; and as the neighbouring hamlets poured forth their inhabitants, at every inlet and promontory, tributary groups from the glens and braes were stationed to behold the welcome pageant, and add their lively cheers to the thunder of the guns and the music of the Inverness-shire militia band, which accompanied the expedition. In passing through Loch-Dochfour, a small lake of unrivalled beauty, which connects the Canal with Loch-Ness, a salute was fired by the yacht in honour of Mr. BAILLIE of Dochfour, who returned the compliment by a discharge of small arms. The venerable and dignified figure of this well-bred gentleman, who stood alone and uncovered on the lawn while the vessel continued in sight, was peculiarly striking. He was loudly cheered by the gentlemen on board. Passing the ferry of Bona, where considerable numbers of people had collected, the vessel glided into Loch-Ness. The scenery at the East end of this magnificent expanse of water, is somewhat stern and cold, without rising into grandeur ; but

advancing to the mouth of Glen Urquhart, its character softens and refines, till the opening of this valley presents one of the loveliest scenes of a land teeming with natural beauty. At this point, where a number of Highlanders were gathered, the Voyagers were joined by Mr. GRANT of Redcastle, Mr. GRANT of Corrimony, the Rev. Mr. SMITH of Urquhart, and several other gentlemen. The reverberation of the firing, repeated and prolonged by a thousand echoes from the surrounding hills, glens and rocks—the martial music—the shouts of the Highlanders—and the answering cheers of the party on board, produced an effect which will not soon be forgotten by those present. Passing onwards and across the lake, the vessel touched at Foyers, where Mr. FRASER of Foyers, Capt. FRASER of Belnain, and Mr. GRANT of Glenmorrison, embarked; and again slanting over towards the house of Invermorrison, a salute was fired and returned from the shore. By these delays it was nearly six o'clock when the yacht entered the locks at Fort Augustus, round which the whole population of the district was assembled, waiting to welcome the long-expected vessel. The dim-seen multitude, the sudden flash of the guns on the shore amid the darkness, the answering flash of those of the yacht, and the music mingling with the joyous acclamations of the crowd, made this twilight landing at Fort Augustus a most imposing spectacle. At Fort Augustus, Mr. GRANT entertained above fifty gentlemen at dinner in the school-house, where they spent a very happy and convivial evening.

Thursday 24th October.

BUT the grand scene of festivity and congratulation was preserved for the ultimate point of the voyage, Fort William, for which place the party embarked at six o'clock on Thursday morning. After sailing about five miles and a half in the Canal, and passing through seven locks, the steam yacht entered at Loch-Oich. On approaching the mansion of Glengarry, which is finely situated on the north bank of this lake, the band struck up

“My name it is Donald Macdonald,” &c.,

and a salute was fired in honour of the Chief, which was returned from the old castle, the now tenantless residence of GLENGARRY'S Ancestors. The Ladies of the family stood in front of the modern mansion waving their handkerchiefs. GLENGARRY had set out by land to Fort Augustus, in order to accompany the party from thence, but met the yacht by the way, as it had started at a much earlier hour than he had calculated upon. He, however, joined the party on Loch-Oich, with his brother, Col. Macdonell of the Guards, and another friend, and proceeded with them to Fort William. GLENGARRY had, in honour of the occasion, requested his tenants to assemble at 11 o'clock, and give the voyagers a *feu de joie*, but the early passage of the vessel through Loch-Oich frustrated this polite intention. The Voyagers were here joined by the *Comet* steam-yacht, which had been politely sent by the proprietors to meet the Commissioner and tender its services. After passing through two locks, and a small portion of the Canal cut through the summit from which the land falls towards the East and West Sea, the yacht entered Loch-Lochy, a beautiful sheet of water of about ten miles in extent, skirted by steep hills lightly feathered with wood along the base, and green to their very summits. To those who are familiar with this district, it is idle to expatiate on the diversified scenes of beauty presented to the voyager in sailing through Loch-Oich and Loch-Lochy; and to strangers verbal description can never give any adequate idea of the ever varying and endless features of pastoral or sylvan beauty which their banks exhibit. In these lakes, as in Loch-Ness, the effect of the firing was heightened to sublimity from the rolling and reverberated sound returned from the surrounding hills and adjacent glens. The group of Highlanders (for all the huts of Lochaber must have been deserted) stationed upon picturesque and commanding points, added not a little to the interest and liveliness of the scene. We were particularly struck by the appearance of a rock called Torguin, the termination of a craggy ridge upon which the people clustered black and thick as a swarm of bees. The last

portion of the Canal was now entered. It is eight miles in length, and contains 12 locks. At Banavie, near Corpach, eight of these grand locks, which are close upon each other, have been fancifully denominated "Neptune's Staircase." Three hours were occupied in passing through these locks and the three other near the sea, so that it was half past five o'clock when the vessel at last dipped her keel into the waters of the Western Ocean, amidst the loud acclamations of her passengers and a great concourse of spectators! The termination of the voyage was marked by a grand salute from the Fort, whilst the Inhabitants of Fort William demonstrated their joy by kindling a large bonfire. A plentiful supply of whisky, given by the gentlemen of Fort William, did not in the least tend to damp the ardour of the populace. At half-past seven o'clock 67 gentlemen, the guests of Mr. GRANT sat down, in the hall of the Mason Lodge, to a handsome and plentiful dinner.

A report of the after-dinner speeches, toasts and "tunes" follows; but here either the *Inverness Courier* or its representative was unequal to the occasion, since, after giving a summary of the speeches to which the first seven toasts led, the account goes on to say, "We cannot pretend to detail all the proceedings of the evening and the many public and personal toasts which were given, but we select the following as the most worthy of notice," thereupon mentioning no fewer than *thirty-two* further toasts which were "drank" on the occasion. Some of these toasts are thus alluded to:—

By Kilcoy—"Mr. Grant of Corrimony." Tune, "Auld Rob Morris that lives in yon Glen."

Corrimony returned thanks in a speech of considerable length, of which we regret we cannot give even an outline.

The health of Glengarry, who had now retired, and his Lady, was drank with much applause.

Colonel Macdonell, in very appropriate terms, returned thanks in the name of his brother, whom he feelingly and warmly eulogized.

After mentioning still more toasts the report concludes:—

We find it impossible to report the speeches of the gentlemen whose healths were drank. Throughout the whole of the evening the unremitting attention of the worthy Chairman, and the lively satisfaction produced by the happy completion of the great work just brought to a close, continued to diffuse harmony and hilarity among the company. At 12 o'clock the party broke up; but some of the gentlemen still remained, and, with genuine Highland spirit, prolonged the festivities of this memorable evening.

This report is distinctly interesting from the point of view of the light it throws on the nature of Scottish conviviality in the year 1822. It will be seen that reference is made to the "plentiful supply of whisky" distributed among the populace at Fort William; but the reporter is discreetly silent as to the consumption of the same beverage in the drinking of at least 39 toasts at the dinner in the evening, without counting those not specified. If he himself honoured them all one may understand, perhaps, why it was that his paper could not give "even an outline" of the later speeches.

The proceedings in connection with the opening of the canal did not conclude, however, with the festivities of a memorable evening prolonged into the small hours of the morning. There was a third day to follow, and the events thereof are thus further narrated:—

Friday 25th October.

IT was intended that Fort Augustus should be the resting place on returning, on Friday, the third day of the trip; and on this account Mr. GRANT and his party

did not leave Corpach till 11 o'clock. On arriving at Fort Augustus, however, about five in the afternoon, the fineness of the evening, the brightness of the rising moon, and the ample supply of *comforts* of all kinds which were on board, determined them to proceed forthwith to Inverness. The beauty of the night, which was remarkably serene and mild, and of the moonlight scenery of Loch-Ness, rendered this perhaps the most interesting part of the expedition. At the openings of those glens which branch off from the lake here and there, like the ribs from a giant spine, several of the gentlemen dropped off, each returning to his hereditary mansion, and subject valley. The music at these times, the splash of the oars which bore away Chieftain and Laird, heard long after the boats had been lost in obscurity, and the prolonged farewell cheers, had a singular and delightful effect. As soon as GLENMORRISTON was landed, his mansion started into a blaze of light, and for some time remained a beautiful object, as seen from the receding vessel. But

“ Different minds incline to different objects.”

While Mr. GRANT and many of the party remained on deck, enjoying the fineness of the night and the scenery, others were happily and quite as enthusiastically, engaged with the more substantial prospects exhibited below by Mr. Bennet, of which, to say truth, no one had wholly lost sight during any part of this first aquatic excursion through the GREAT GLEN OF SCOTLAND. About 12 o'clock, P.M., the yacht reached the draw-bridge at Bught, having made her homeward voyage from the West Sea in 13 hours, including the several stoppages.

The interesting object of the voyage, agreeable society, music, scenery and good cheer, must have given this excursion a deep, and, we are persuaded, a lasting impression in the memory of all who were present. Nor will the polite attention of Mr. GRANT—though he was necessarily much engaged with the Resident Engineers in examining the WORKS—be soon forgotten by any individual who had the honour of accompanying him. To his mind, the fortunate completion of a design, which had for its main object the improvement of that country to which he has ever so zealously devoted himself, and which must have often been to him a subject of much care and anxiety, could not fail to impart a high degree of satisfaction.

THE GLASGOW, PAISLEY AND ARDROSSAN CANAL.

If no reference has hitherto been made in the present work to the Glasgow, Paisley and Ardrossan Canal, the reason therefor is that, inasmuch as the canal was never completed, while the portion of it which was constructed no longer exists, the said waterway does not constitute, as the other canals dealt with may be said to do, a question of the day. There is, however, much that is of interest in the history of an undertaking of which comparatively few of the British public have probably heard, and in a volume dealing with Scottish Canals and Waterways in general the Glasgow, Paisley and Ardrossan should certainly not be ignored—even although, for the considerations stated, it may have been relegated to an Appendix.

Somewhere about a century or a century and a half ago the River Clyde between Glasgow and the sea was a shallow stream navigable only by fishing wherries of not more than 4 ft. or 5 ft. draught. It was even fordable on foot at Dumbuck Ford, twelve miles below Glasgow, and at Glasgow itself the depth of water at low tide was only 15 in.¹ Port Glasgow, situate at a point

¹ At the Court of Inquiry concerning Transport Workers (wages and conditions of employment of dock labour) held in London in the early part of 1920, the chairman, the Right Hon. Lord Shaw of Dunfermline, said to Mr. James Macfarlane, treasurer of the Clyde Navigation, who gave evidence concerning labour conditions on the Clyde:—“ You may like to know, in my own personal acquaintance, that an aged man told me that as a boy he had waded across the Clyde two miles below the Broomielaw from one bank to the other; and now, I suppose, there is a draught of 30 ft. of water?” Mr. Macfarlane replied that the present depth of water was 36 ft.

three miles above Greenock, had been set up by the city of Glasgow in 1668 to accommodate vessels of larger burden which could not be brought up to Glasgow itself, and though, in 1765, efforts on a systematic basis were begun with a view to rectifying and deepening the channel of the river, no really material improvement was effected for many years to come—with the final result, however, that the Clyde, great and powerful a stream as it is to-day, represents the handiwork of skilled engineers rather than an original creation on the part of Dame Nature.

Then, also, the navigation of the Firth of Clyde from the Cumbræes to the mouth of the Clyde river was, in the same early days, often “ baffling and tedious ” for the sailing ships then in vogue ; and the suggestion was made that the combination of difficulties would best be met by constructing, from Saltcoats—situate on the northern shore of Ayr Bay, the entrance to the Firth of Clyde—to Paisley and Glasgow, a navigable canal which would cut off the angle formed by firth and river, and enable vessels to reach Glasgow by an inland passage. In 1791 a committee was formed to further the project, and a fund to defray the cost of a survey was opened. Towards this fund the Paisley Town Council contributed £5, and in 1803 the same body sent to the committee a memorandum recommending that between Paisley and Glasgow the canal should be made in a straight line.

A new development was brought about when Hugh, twelfth Earl of Eglinton, had the idea of constructing at Ardrossan—one mile W.N.W. of Saltcoats—a harbour on a large scale which—supplemented by a navigable canal extending therefrom through Paisley to “ the village of Tradestown,” situate on the southern bank of the Clyde at Glasgow, and immediately opposite the Broomielaw—was designed to make a much more convenient port for Glasgow than the one near Greenock. The canal would have a length of $31\frac{1}{2}$ miles, and the Glasgow terminus was to be in Eglinton Street, Tradestown, immediately south of where that street is now crossed by the Glasgow and South Western Railway.

The prospects of the undertaking are thus referred to in a pamphlet of 22 pp., 8vo, published in Glasgow in 1807 under the title of “ Observations on the Glasgow, Paisley and Ardrossan Canal and Harbour at Ardrossan ”¹ :—

Almost every circumstance concurs to assimilate these undertakings to Liverpool and the well known canal of the Duke of Bridgewater. A well-grounded hope may therefore be entertained that Ardrossan may become to Glasgow what Liverpool has long been to Manchester.

Ardrossan is situated equally favourably for foreign trade with Liverpool ; but the Bay of Ardrossan (already formed by nature as a complete harbour for all the purposes of safety, at the southern extremity of which the harbour and docks are to be formed) is free from obstructions which render navigation dangerous.

The writer went on to say that, like Liverpool, Ardrossan had behind it a manufacturing country which was full of coal, ironstone and limestone, and it had, also, a population of 300,000. The situation of the harbour would offer the advantages of interchange of products with Ireland, together with an interchange of commodities with every part of the United Kingdom. Ardrossan was immediately opposite the north coast of Ireland ; communication with the entire west coast of Great Britain would be easy ; commodities would be taken by canal to Glasgow, and thence by the Forth and Clyde Canal to the

¹ A copy of this pamphlet will be found in the Mitchell Library, Glasgow.

Firth of Forth, or they could be conveyed by the Crinan Canal and the Caledonian Canals to the north-western, northern or eastern parts of Great Britain.

In the same pamphlet there are published two letters addressed to the Earl of Eglinton by Captain Sandford Tatham, R.N., Regulating Officer for the district in which Ardrossan is situated. Among other arguments advanced by him in support of the harbour and canal scheme he said :—

The ports of Greenock and Port Glasgow at present form the medium of commercial intercourse with the city of Glasgow and the interior country ; hence in addition to the delay of ships working up the Clyde to those ports, the carriage of every article of commerce labours under many difficulties. This carriage is either in a direct line by land or by water to Glasgow and from thence by carts to the interior ; and by whichever mode goods are conveyed, it occasions not only considerable delay but often material damage either by friction in land-carriage or by loading or unloading.

Dealing with the question of prospective freight, Captain Tatham showed how this might be expected to come from, among other sources, the manufactories of Glasgow and Paisley and the iron-works of the Clyde and the Carron ; he suggested that Ardrossan offered advantages of a superior kind for communication with the Caledonian Canal either through the Crinan Canal or round the Mull of Kintyre, and he believed that trade would also be developed between Ardrossan and Holland, the Baltic, Norway, Sweden, Russia, Canada and America. He further pointed out that, in case of emergency, a more speedy conveyance of troops and their baggage from Glasgow would be made available. Thanks to the canal, a complete regiment, with their baggage, etc., might be embarked at Ardrossan and fairly out at sea within eight hours of the time of their leaving Glasgow, whereas under the then existing circumstances they would not be able to do this in less than two days.

“ An Act for erecting and maintaining a Harbour, Docks, and other Works, at Ardrossan, in the County of Ayr,” received the Royal Assent on May 17, 1805, the preamble stating :—

Whereas there is a Promontory or Point, called Ardrossan, in the Parish of Ardrossan, in the County of Ayr, terminated by a Ridge of Rocks, stretching for a considerable Way into the Sea in a North-West Direction, immediately opposite to which, at the distance of about Half a Mile to the North-West, there is an Island called The Horse Isle, stretching nearly in a North and South Direction, which Promontory and Ridge of Rocks on the one Side, and the said Island on the other, completely protect a capacious Bay formed between them from the Winds and Storms : And whereas there is a Depth of Water to the Extent of about Thirty Feet at Low Water in ordinary Spring Tides, between the Extremity of the said Ridge of Rocks towards the Sea and the said Island being the Entrance to the said Bay, and within the same there is a depth of from Twelve to Eighteen Feet at Low Water in ordinary Spring Tides, with good Anchorage Ground, and the Tide rises to the height of about Ten Feet in ordinary Spring Tides, and Seven Feet at Neap Tides : And whereas the said Bay may be formed into a safe and commodious Harbour, which may be entered at all Times of the Tide, and with any Wind, by Vessels of the largest Burthen, by constructing Piers upon the said Ridge of Rocks, whereby a safe and commodious Station may be afforded to Ships of War on that Part of the Coast, and the Trade of that Part of the United Kingdom, and the Intercourse between Ireland and Scotland may be greatly promoted, and the Shipping resorting thereto may be further accommodated, by the Erection of Wet Docks and Basons, and the constructing of other Works for that Purpose, for which the Situation of the Place is peculiarly favourable : And whereas several Persons have

entered into a Subscription towards raising a Capital or Joint Stock or Fund for making or completing such Harbour, Wet Docks, Basons, and other Works; but the same cannot be made and completed without the Aid and Authority of Parliament; may it therefore please Your Majesty that it may be enacted, etc.

Meanwhile surveys, plans and estimates for a canal to connect the harbour at Ardrossan with the Clyde at Tradestown, near Glasgow, were made by Telford, who put the cost of construction at £125,896, and an Act authorising the making and maintaining of the canal, with a collateral cut to "the Coal Works at Hurlet, in the County of Renfrew," was obtained in June, 1806. The Act stated that the canal would—

Enable the Inhabitants of Ireland to be supplied with Coal from the Mines of Coal with which the District of Country through which the said Canal is proposed to be carried, abounds, and to send from Ireland Grain for the Consumption of the Inhabitants of Glasgow and Paisley; and the said Navigable Canal, Feeders and Collateral Cut will farther facilitate, and render less expensive, the Carriage and Conveyance of Commodities between Glasgow and Paisley; and also of Coals, Timber, Stone, Iron Stone, Lime Stone, Slate, Lead, Sand, Lime, Manure, and of all Goods, Wares and other Articles, and will materially assist the Commerce and Agriculture of the circumjacent Country, and will otherwise be of great public Advantage.

The Earl of Eglinton, certain landed proprietors along the line of route, some merchants of the city of Glasgow, and others were constituted into a company with a capital of £140,000 in shares of £50 each, and authority was given to them to borrow a further sum of £30,000 on the security of the undertaking, if necessary.

The amount of capital actually subscribed was only £44,342; but the company decided to construct the canal from Glasgow through Paisley to Johnstone, a distance of about ten miles. Work was begun at the Glasgow end in 1807. The estimated cost of the undertaking as far as Johnstone was £49,000; but even before this initial section had been finished the sum expended thereon was no less than £100,000. Various loans were raised to supplement the amount subscribed, the Paisley Town Council, which had strong views as to the utility and eventual success of the work, having, on September 5th, 1809, agreed to guarantee, with ten other holders of shares, any sum it might be found necessary to borrow for the completion of "that public and useful undertaking." The canal was opened for traffic as far as Paisley on November 6th, 1810, and four days later, on the occasion of a fair at Paisley, a boat on the service, the *Countess of Eglinton*, was capsized owing to the eagerness of the crowd of passengers to get on board for the return journey. Eighty-eight persons were drowned. Completed to Johnstone, the canal was formally opened, with much ceremony, on October 4th, 1811.

The canal had a depth of $4\frac{1}{2}$ ft., and a breadth of 28 ft. for the greater portion of its course. Any resort to the use of locks was avoided by the following of a somewhat tortuous course—a procedure which, as we have seen, the Paisley Corporation had been desirous of avoiding. The canal dues ranged, in five classes and in gradations of one penny, from twopence per ton per mile for raw materials, such as iron-stone, limestone, clay, sand, etc., to sixpence per ton per mile for general merchandise, plus basin charges for loading and unloading. In 1831 the quantity of goods carried was 48,181 tons; in 1836 the total was 67,305 tons.

Passenger boats, carrying in the first instance 120 persons, took two hours to go between Glasgow and Paisley ; but in 1832 a lighter boat, accommodating 100 passengers and drawn by two horses, did the journey in about an hour. The number of passengers carried in 1831 was 79,455. In 1836 this figure had increased to 423,186.

Meanwhile the conclusion had been formed that it would be impracticable, if not impossible, for financial reasons, to continue the canal from Johnstone to Ardrossan, in accordance with the original programme. Adopting the view that a railway for the remainder of the distance would be less expensive and equally convenient and advantageous, the company obtained in 1827 an Act which empowered them to build a railway from the canal terminus at Johnstone to the harbour at Ardrossan, together with two branches, and to raise for the purpose £95,658, the balance of the capital authorized by their Act of 1806 which they had failed to secure for the purposes of the canal.

Once again the company met with discouragement. Of the £95,000 they wanted, they could get no more than £28,300 by the issue of shares, and, although they secured a further £20,000 by means of a loan, they were not able to take the proposed railway further from Ardrossan—where they made the start—than Kilwinning, a distance of no more than 5 miles, 6 chains. The time allowed for completion expired before any extension beyond Kilwinning could be assured ; the combination of canal and railway in the hands of one and the same company was found to have occasioned “ great expense and inconvenience,” and in 1840 the company sought for, and obtained, an Act “ for separating the management of the Ardrossan and Johnstone Railway from the management of the Glasgow, Paisley and Ardrossan Canal, for incorporating the proprietors thereof, for doubling and improving the railway, and for other purposes.” The separate company thus formed by the railway shareholders as distinct from the canal shareholders was known as the Ardrossan Railway Company.

It was now found possible to double the existing line, though impossible to raise the money for extending it to Johnstone. In 1846 an arrangement was made for the transfer of the Ardrossan Railway to the Glasgow, Kilmarnock and Ayr Railway Company ; but litigation followed thereon, and in 1854 the Ardrossan Railway was acquired by the Glasgow and South Western Railway Company.

The troubles of the Ardrossan railway were thus at last ended ; but the Glasgow, Paisley and Johnstone Canal Company were still carrying on an apparently hopeless struggle to maintain an independent existence.

There had long been much communication between Glasgow and Paisley. Towards the end of the eighteenth century there was already a “ diligence ” as well as a carrier’s cart plying regularly between them, and by 1824 the number of coaches competing for the passenger traffic—apart from what was being done in respect to goods traffic—was no fewer than thirty-two. The canal was able to divert to itself a certain proportion of the road traffic during the early stages of its existence ; but as the railways developed the waterway was less and less wanted. It had never been a financial success, and eventually it reached a stage when the outlook became hopeless indeed. In 1868 interest on the preference debt was £1,265 in arrear, the arrears of interest on a deferred debt of £13,793 amounted to £34,793, while none of the principal had been paid off—or was likely to be paid off under the then existing conditions.

So it was that in a Bill presented to Parliament in 1869, “ to vest the Glas-

gow, Paisley and Johnstone Canal in the Glasgow and South Western Railway Company," the representation was made that "it would be of great advantage to the public as well as to the canal company and the creditors and the railway company" if the undertaking of the canal company were vested in the railway company; though it was provided that, in this case, the railway company—

Shall at all times keep the canal . . . open and navigable for all persons desirous to use and navigate the same . . . and shall at all times keep the canal and the works connected therewith well and sufficiently repaired, supported, dredged, cleansed, scoured and maintained in good order and condition, unavoidable stoppage from accidents, unusual drought or severe frost or for cleansing, repair or execution of necessary works, excepted.

The Bill was passed by Parliament, the canal company was dissolved, and the railway company, as the new owners of the canal, were required to provide out of canal revenue otherwise available for dividend £3,471 12s. 8d. per annum, to be applied to payment of arrears of interest on the canal debts, then in clearing off the debts themselves, and finally as dividends to the shareholders.

Still another, and, this time, a concluding, chapter in the history of the enterprise was to follow. The railway company discharged to the letter all the responsibilities they had undertaken; but the fact became every year more and more evident that this 10-mile canal was no longer required by traders or the public, that it had no chance of securing remunerative traffic in competition with the superior advantages offered by the railways, and that the land it occupied might be devoted to a better purpose. In 1881, when the Glasgow and South Western found it desirable to construct certain new lines in the interests of their steadily-growing railway traffic, they sought the sanction of Parliament for a "Paisley Canal Line" which, in great part, would be laid along and upon the site of the canal between Glasgow, Paisley and Johnstone. They secured their Act, they were authorized to close the canal, and they were relieved from all obligation or liability to maintain and keep open the navigation. To-day the canal exists only in the name borne by a railway line which now conveys a busy traffic where a no-longer-needed canal had outlived its period of practical utility.

Whilst the story of the Glasgow, Paisley and Ardrossan Canal is thus found to relate to the past, it is worth recalling here, not only because it is a Scottish story appropriate to the present volume, but also because of its direct bearing on two questions that really are of present-day interest—(1) the conditions under which railway companies acquired the canals that have passed under their control, and (2) the utilization of canals, whether railway-owned or otherwise, for more useful purposes when the traffic upon them has dwindled to the proportions of a negligible quantity, even if it should not have disappeared altogether.

EXPERIMENTS IN CANAL NAVIGATION.

The success which attended the early introduction of passenger traffic on the Forth and Clyde, the Monkwell, the Edinburgh and Glasgow Union and the Glasgow, Paisley and Ardrossan Canals led to experiments being made on all these different waterways with a view, first of all, to accelerating the speed to be obtained by horse traction, and next, to ascertaining whether the still higher speed likely to be effected by a resort to steam power would be practicable from the point of view, more especially, of injury to the canal banks.

Some interesting details concerning the steps taken in these directions will be found in a book published in 1831, under the title of "Remarks on Canal Navigation, illustrative of the Advantages of the Use of Steam as a Moving Power on Canals," the author being William Fairbairn, a member of the firm of Messrs. Fairbairn and Lillie, engineers, of Manchester. The Managing Committees of the Forth and Clyde and the Edinburgh and Glasgow Canals had, at that time, each contracted for the construction of a steam-boat to ply on their respective canals, and Fairbairn had prepared for the former an improved goods and luggage boat, with two stern paddles. He was also in close communication with a Mr. Grahame, who was seeking to impress on the managers of the Forth and Clyde Canal the superior advantages of steam power over animal traction, more particularly in regard to the transport of passengers. At that time, however, the Forth and Clyde Company, still anxious about their canal banks, were not disposed to try any fresh expedients until they had completed the operations on which they had started with a view to facing the banks of their canal with stone.

Meanwhile, at the instigation of Mr. William Houston, of Johnstone, the Committee of Management of the Glasgow, Paisley and Ardrossan Canal were led to start on some experiments directed to showing the rate of speed at which a boat of specially light construction could be taken along that canal without risk of injury to the banks. These experiments were made with a long and narrow "gig" rowing-boat, 30 ft. in length, and having ten men on board; and the boat was drawn through the water by one horse, ridden by a canal driver, for a distance of two miles in ten minutes, or at the rate of twelve miles an hour, "without any surge or agitation of the water so as to injure the banks."

A certain unsteadiness gave the impression of a lack of safety for the passengers in a boat of these dimensions taken through the water at such a speed; but the Committee of Management were so far encouraged by the absence of injury to the canal banks that they built a gig-shaped passage boat 60 ft. in length and 4 ft. 6 in. in breadth, to carry a larger number of passengers; and here again it was found that, the greater the velocity of the boat, the more complete, except under certain conditions, was the disappearance of wave and surge. These results were considered the more satisfactory since the Paisley Canal was very narrow throughout. At the bridges and many other places it was only 9 ft. broad, the canal being, in fact, one of the narrowest in Scotland, and it had, besides, a great number of turns, many of them very sudden. Notwithstanding these disadvantages, the boat was, at the time Fairbairn wrote, regularly plying between Glasgow, Paisley and Johnstone, carrying between forty and fifty passengers per trip.

These experiments on the Glasgow, Paisley and Ardrossan Canal encouraged the making of trials on the Forth and Clyde Canal with a twin boat, 60 ft. long, 8 ft. 6 in. broad, and built to carry between fifty and sixty passengers. It was found that, when free from locks, tunnels and other impediments to free navigation, the boat could go at a speed ranging from six to twelve miles an hour under conditions which fully confirmed the results already attained on the Glasgow, Paisley and Ardrossan Canal. Thus, when the speed of the boat was from six to seven miles an hour, there was a great wave or swell constantly in front, followed by a strong surge or wave bearing against the bank of the canal. The horses, also, were much distressed. In proportion, however, as the speed increased, the wave or swell of water in front sank down,

and when a speed of about nine miles an hour was attained, the swell disappeared, the waters in front became smooth and level, little or no surge was seen on the banks behind the vessel, and the horses were no longer so distressed. In Fairbairn's opinion, the experiments seemed to establish the principle that the greater the speed the less the surge, and that a gig-shaped boat, moving at a velocity of nine miles an hour, completely surmounted the surge and rode over the accumulating swell that otherwise would have risen in her front. He thus regarded the prospects of an application of steam power to canal traction as distinctly favourable.

The immediate effect of these experiments on the transport arrangements was that measures were taken to keep the speed of the boats on the Forth and Clyde Canal at the highest possible rate, the length of time taken for the journey between Edinburgh and Glasgow being reduced to five hours.

Similar experiences were also gained on the Monkland Canal, on which, again, corresponding arrangements were made in regard to the passenger traffic.

Then in the library of the Institution of Civil Engineers, in London, there is to be found what may possibly be a unique copy of a most interesting "Report of the Practical Results of Experiments on Canal Navigation ordered by the Committees of Management of the Forth and Clyde and Edinburgh and Glasgow Union Canals"—a little work of 10 pages, 4to, written by R. Ellis, and dated: "Canal Office, Edinburgh, February 7th, 1835." From this one learns that the Committees of Management of the two companies mentioned had "voted a fund for defraying the expense of experiments calculated to throw light on the principles connected with the passenger boats lately introduced on canals," and that numerous observations had been made on the Paisley Canal, the Forth and Clyde Canal and the Union Canal with the object of seeing whether, by a peculiar construction of boat, the obstacles to the use of steam power on canals could not be removed. These further experiments, extending over a period of three months, had, it was stated, "brought to light a series of the most beautiful and astonishing but simple laws—laws that are entirely at variance with generally received opinions, and will soon assign to canal navigation a high rank as an improved species of inland intercourse."

The said beautiful and astonishing but simple laws related more especially to questions of wave resistance and the laws of velocity, and, with much technical detail, into which it is unnecessary here to enter, Mr. Ellis tells how, for the purpose of determining the principles which regulate universally the laws of motion in canals, with the best form of the vessels to be transported and the dimensions and form to be given to a canal for the purpose of rendering it most suitable to the desired rate of motion, a skiff, "of very peculiar construction," was built, by means of which a velocity of more than twenty-one miles an hour was obtained, "being by far the highest velocity ever attained on a canal, and limited only by the speed of the animal used to produce the motion." Other of the experiments made related to the resistance to vessels moving with two different velocities in the same canals.

Having regard to all the facts here indicated concerning the said experiments and the application of their results to canal navigation, one begins to understand more clearly how it was that the horses attached to the passenger boats were urged along the towing paths at top speed; the reason for their having to be changed so frequently at the stables set up every two miles along the line of route, and why it was that passengers travelling by the long and

narrow gig-boats favoured in the interests of speed were requested by the Edinburgh and Glasgow Union Canal Company "not to reach over the windows or sides of the boat, as doing so puts the boat out of proper trim."

It was highly to the credit of the Scottish canal companies that they showed all this enterprise and spirit of progress in the conduct of their undertakings, and their whole policy in these directions was once more in marked contrast to the attitude of the State in its management of the Caledonian and Crinan Canals, with which incomplete and never-finished waterways it was content to do nothing beyond what was necessary to prevent them from becoming derelict. One must also sympathize with the Scottish companies in their desire to make canal communication attain a high rank as an improved species of inland communication, and they deserve great credit for what they did. But economic fate and the march of progress were against them, and we have seen in the preceding pages how their enterprise, their dreams and their aspirations were all to be set at nought by the introduction of an even superior means of inland intercourse in the locomotive; though in the first instance there was, also, another agency at work, to the prejudice of canal navigation, as shown by Telford's references to the Glasgow, Paisley and Ardrossan Canal in the story of his "Life," told by himself and edited by John Rickman (1838):—

This canal affords a remarkable instance of the rapid progress of invention:—The introduction of iron railways, traversed by locomotive steam-engines, having threatened to supersede the intercourse by navigable canals, induced an enlightened canal proprietor, Mr. Houston, of Johnstone, near Paisley, to adopt a scheme entirely opposite to the received opinion respecting the motion of loaded boats upon canals; that is to say, he discovered and proved experimentally, that with increase of speed the proportion of resistance is not increased but diminished; so that a loaded boat, moving with a velocity of ten miles per hour, requires less tractive force than the same boat moving at five miles; this fact, well established, has enabled Mr. Houston, for several years past, to work passage-boats between Glasgow and Paisley with advantage much beyond the slow pace formerly in use; but while this new mode of conveyance was proceeding successfully and profitably, and was adopted on other canals, an equally unexpected discovery came into competition; that is, by running locomotive steam carriages upon the turnpike road between Glasgow and Paisley, and so conveying passengers in as short a time, and at a cheaper rate, than even the before-mentioned rapid passage-boats on the canal.

THE GLASGOW AND EDINBURGH UNION CANAL.

(FROM *The Scots' Magazine* FOR JANUARY, 1824.)

Owing to the rapid increase of trade on the Union Canal, the present basin at Port-Hopetoun has been found inadequate to accommodate the numerous barges which are now plying on that navigation. The Canal Company have therefore resolved to construct another basin, in addition to the present one, considerably larger than it, and in the same neighbourhood. For this purpose they have purchased ground immediately behind Semple-Street, upon which it is understood they are soon to commence operations. Within the last few months the coal trade has been carried to an immense extent, and is still to be greatly augmented. All sorts of building-materials, for which there is at present in Edinburgh an uncommon demand, are now brought by this conveyance—as timber, stone, slate, brick, sand and lime, the latter article having been recently added to the number. Westward, the carrying trade is necessarily more limited, being chiefly confined to merchant-goods and manure. It will

perhaps be recollected that the expectation of Mid-Lothian being supplied with coal from the valley of the Clyde was treated as chimerical by some engineers in the course of the discussions which took place a few years ago about the line of a canal. It is a fact, however, that a barge laden with coal lately arrived at Port-Hopetoun "from the coal works seven miles *beyond* Glasgow," as the people on board stated. This boat had consequently entered the Forth and Clyde by the Monkland, and had come nearly *seventy* miles, passing, in its course, through fifteen locks. A Glasgow coal-yard is indeed established at Port-Hopetoun, from which we may infer that coal is regularly brought from that quarter. A great impulse seems to have been given lately in building, both dwelling-houses and warehouses, in the vicinity of the canal basin. A fine large building, for the luggage-boat companies, is now getting up at the basin, upon the projecting square used as a landing-place for passengers, and several offices for the coal-companies have just been completed. The greatest activity is employed in raising houses of the usual height of five stories in the adjoining streets and roads, the stone of which is brought from Redhall quarry, three miles to the westward, on the banks of the canal. Several boats from this quarry are constantly employed—each carrying between 40 and 50 tons, and making generally three trips in a day. Such are the expectations of a still-increasing trade on this canal, that one boat-builder, in the vicinity of the basin, has contracted, since the middle of summer, for building *ten* boats. Vessels are also frequently launched from the yard at the west end of Gilmour Place, and three are now building at Leith. It is not a little extraordinary to find the cow-feeders of Edinburgh are now supplied with draff from a distillery at the distance of 35 miles. One brings about 40 tons weekly of this article. We understand that a project is now in agitation, which, in course of time, may create a little town at the farther end of this canal. The Company, from the difficulty of getting a part of Glenfuir grounds, which lie at the junction of the Union Canal with the Forth and Clyde, were obliged to purchase the estate altogether. That part which they have not occasion for being divided by the canal, and cut by several roads, lessens the inducement to any person to purchase it in a single lot. It is therefore proposed, after setting aside the necessary portion for wharves, quays, officers' lodges, and inns for the accommodation of passengers, to sell or feu the rest in small lots for building, or in larger lots, which the purchaser may let or feu in portions as minute as he pleases. The situation is considered as extremely eligible for manufacturing establishments, such as ironworks, distilleries, &c. Works erected here would be in the immediate neighbourhood of exhaustible mines of coal, lime and iron-stone, while the rich district of the Carse would afford them corn with very little expense of carriage. Placed at the junction of these great lines of water communication, they could command the markets of Glasgow, Greenock, Edinburgh, Stirling, with all the towns on the Forth and Clyde, and procure on the easiest terms all the products of the Baltic, America, and the West Indies.

POSTSCRIPT.

Whilst this work was passing through the press, there was held at the Royal United Service Institution, London, on July 31st, 1922, what was reported in the *Glasgow Herald* of the following day as the annual meeting of the "Mid-Scotland Ship Canal National Association," otherwise the parent body, as distinct from the "Mid-Scotland Ship Canal National Association

(Glasgow and West of Scotland).” This was the first meeting of the former—if not, also, the first public evidence of its continued existence—since the outbreak of war, close on eight years previously, and inasmuch as, during this interval, all activity in the matter seemed to be centred in the Glasgow “branch,” it was only a natural assumption which had been entertained that the earlier body was practically, if not actually, defunct, and that the latter had taken its place.

Curiously enough, also, the proceedings on the occasion in question afforded evidence of a distinct difference in aim, purpose and policy between the mother and the daughter organization. Speaking as Hon. Secretary of the original body, Dr. W. A. Chapple reviewed the general position, and said, among other things :—

At the moment there was *no final decision of engineering experts as to which was the better route*, and there was no very conclusive evidence as to the amount of mercantile shipping that the canal would cater for. What was needed now was a Commission, on which engineering experts, shipping interests and the Admiralty would be represented, charged with the duty of securing all the relevant data *and of giving a final judgment on the rival routes and on the comparative costs.*

On the other hand Mr. Bird, Hon. Secretary of the Glasgow Branch, who followed Dr. Chapple, after expressing the opinion that the only hope for getting on with the canal would be for all parties to unite on one route proceeded :—

He was sorry Dr. Chapple’s report mentioned an inquiry into the Direct Route and the Loch Lomond Route. *They hoped in Glasgow that they had passed all that, and that the only route to be considered was the Grangemouth to Yoker Direct Route. That was the feeling in Glasgow.* . . . They felt now that they had pressed the matter in every direction. It had been so long before the public, had been so much discussed, and had been so much ventilated in different ways that the Government should appoint engineers to *make a report on the feasibility of the scheme* and its probable cost. The Association should press for this report and bring the matter to a point.

In regard to future action, Bailie W. B. Smith, a member of the Glasgow Corporation, proposed a resolution requesting the Secretary for Scotland to press upon the Government the desirability of *proceeding with the construction of the canal by the Direct Route at sea level* as “a work of national importance which would give useful and remunerative work to thousands of men who were at present receiving unemployment pay.” The Glasgow Corporation, he said, had approved of this route, and considered it “a matter of importance which should be done by the nation.”

While supporting this resolution, which was subsequently adopted, Dr. Chapple—

Contended that if the survey were held, the Government would be bound to take into consideration the fact that there were other people who favoured the Loch Lomond alternative route. They could safely rely upon those inclined to favour this route coming forward and stating their opinions, and the Government would have to decide between the two.

Another speaker, in concurring with Dr. Chapple, expressed the opinion that those who undertook the responsibility of getting the money to build the canal must decide which route was the one most suitable for them.

There was thus, in effect, complete divergence between the representatives of the London association and those of the Glasgow association since the latter took it for granted that the route favoured by themselves was the only

one that should come into consideration at all, and the only one as to which the proposed Government survey and report should be drawn up.

Once more, therefore, it was a case, so far as the Glasgow Branch was concerned, of furthering "Glasgow's interests," if not, indeed, of proclaiming "Glasgow, Glasgow, über alles!" Just because the Glasgow Branch had made up its mind, and had received the support of the Corporation of that city, therefore the Government, if it entered upon any public inquiry at all, was to do so pledged to concern itself only with the Direct Route, and prepared to ignore any other route that other interests or other authorities might recommend instead.

The importance of the resolution passed by the meeting and the weight to be attached to the fresh demands upon the Government were certainly diminished by the difference in view between the London section and the Glasgow section respectively, while there was no less significance in the fact that the combined attendance of representatives of these two so-called "National" associations—speaking, theoretically, in the name of the nation—consisted of no more than about a score of persons. The whole business, in fact, recalls the story of the "Three Tailors of Tooley Street" who began their petition: "We, the people of England."

Another new development in the situation has arisen out of a reference made to the Caledonian and Crinan Canals by the Geddes Committee on National Expenditure in their Second Interim Report [Cmd. 1582]:—

It is questionable whether the Caledonian and Crinan Canals satisfy the test of national importance, and arrangements should, if possible, be made for their control and management to be undertaken by local bodies.

Acting on this suggestion, the Ministry of Transport has now addressed a communication to the County Councils of Inverness-shire and Argyll, calling attention to this paragraph and inquiring whether they would be disposed to take action along the lines indicated, the former in respect to the Caledonian Canal and the latter in regard to the Crinan.

Pending the receipt of replies from the County Councils, which, it is understood, still have the matter under consideration, one cannot say for certain what course they will be likely to adopt. The probability, however, of their concurring in the view taken by the Geddes Committee would seem to be extremely remote. The proposal is no more than an application to both canals of the view taken by the Treasury in 1911 in regard to the Crinan Canal, and already, in effect, dissented from successively by the Royal Commission on Canals and Waterways, the Rural Transport (Scotland) Committee, the Ministry of Transport Crinan Canal Committee, and, on repeated occasions, by the Argyll County Council, while the Caledonian Canal, which constitutes an ocean highway for, among other users, fishermen from the east coast of England to the fisheries on the west coast of Scotland, should, assuredly, be regarded as much more than a matter of purely local concern. Considering, also, that both canals belong to the Government, and that both of them gave proof of their value as a national asset in the Great War, it is, surely, too much to expect that the said County Councils, even if the communities they represent were not already nearly crippled with taxation, would be prepared to relieve the Government of the responsibilities of ownership by themselves undertaking the financial burdens which "control and management"—including, apparently, the cost of at last completing the canals, if not of effecting their reconstruction—would necessarily involve.

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