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All communications for the Society should be addressed to the Secretary, John-street, Adelphi, London, W.C.

CHAIRMAN OF COUNCIL.

General Cotton being at present unable, on account of the state of his health, to discharge the duties of Chairman, Mr. William Hawes has consented, at the request of the Council, to act as Deputy-Chairman during General Cotton's enforced absence. The usual opening address at the commencement of the Session will therefore be made by Mr. Hawes, on the 21st instant.

FIUME AND HER NEW PORT.

By George L. Faber,

H.B.M. Vice-Consul at Fiume.

A WORD TO THE READER.

[Fiume, the chief, indeed the only port of the kingdom of Hungary, is but little known to the English public; and the few passing tourists have been surprised to find themselves in one of the cleanest and neatest of harbour towns, faced by glorious scenery, almost rivalling that of far-famed Parthenope. Moreover, at this moment in England everything Austro-Hungarian has acquired, with a view to political contingencies, an especial importance and an interest which did not belong to it a year or two ago.

I have, therefore, little doubt that the following paper will be well received and extensively read. It was drawn up, at my suggestion, as a pendant to "The Port of Trieste, Ancient and Modern" (*Journal of the Society of Arts*, October 29th and November 5th, 1875), by Mr. George L. Faber, who, as Her Majesty's Vice-Consul for Fiume, has the best opportunities of studying local conditions. He begins by borrowing from the excellent monograph of Dr. Joseph A. Lorenz ("Topographie von Fiume und Umgebung vom naturwissenschaftlichen, historisch-statistischen und sanitären Standpunkte, etc. Wien. Carl Gerold's Sohn, 1869); which has appeared in Italian as well as in German; and whose value will be recognised when publishers choose to give us a "serious" hand-book for the Adriatic. Mr. Faber then describes the new port at full length; and here the matter may be considered original, having been supplied by the engineer officers in the Austrian service.

Mr. Faber's opinions concerning the railways lately opened at Fiume are those of the community in general, and they have already been ably expressed by M. Louis Frankovich, formerly her Majesty's Acting Consul for Fiume ("Reports of her Majesty's Consuls during 1876," Part II., pp. 111-112. London: Harrison). They are, it will be seen, opposed to the theories of Mr. Thomas A. Welton, F.S.S. This practised student of statistics speaking of my paper, "The Trade of Trieste," based upon the pamphlet of M. Franz Rziha ("Die Bedeutung des Hafens von Trieste für Oesterrich," *Journal of the Society of Arts*, Sept. 15 and 22, 1876), objects as follows to the main idea of the Austrian engineer, namely, that trade would flow back to Trieste were the network of her railway communication made complete:—

"Ordered cargoes always go where the owner wants them; it is only market cargoes which can be influenced by inducements. When few lines of railway existed, Trieste must have received cargoes upon order sufficient to supply the district with which she dealt. Now that railways are many, it may have become a wiser and a less speculative proceeding to look to market cargoes for supplies of valuable articles, like coffee, even if these market cargoes all go to the north. To some extent, it may be feasible (!) to catch vessels at Suez, and direct them to Trieste; but the chances are, that market cargoes will continue to come to this end of the world (London) in such quantities that it may better suit the Bohemians, for instance, to try in the north than to bring in articles via Trieste. Besides, by dealing with London, or any other large mart, the necessity of holding extensive stocks is saved; purchasers, taking their requirements from hand to mouth, economise capital, and they need not buy a whole cargo of anything. This is a growing tendency in English trade, fostered by the use of the steamer and the telegraph."

Theoretically, there is nothing to object to in these words; practically, much. The present object of all the great Adriatic ports is to deal direct with the East, and Mr. Magniac (the *Times*, May 19, 1877) has shown how much the Suez Canal has injured British trade—a fact known to any officer of the "P. and O."—by the advantages it has offered to our southern rivals. But what is the use of importing either ordered or market cargoes direct to Fiume, for instance, if a vast railway monopoly compels the trade, by preferential tariffs and other contrivances, to flow into the northern channel, via Trieste? The fact is, Mr. Welton, familiar with the complicated conditions of "high commerce," would apply its lessons to a comparatively primitive stage; and the latter practically rejects them, and will reject them, probably, for another generation.

RICHARD F. BURTON.

Trieste, July 11, 1877.

P.S.—The few explanatory notes which I have appended to Mr. Faber's careful and conscientious study are signed with my initials, in order that readers may not hold the author responsible for the opinions of an "outsider."]

SECTION I.—Historical Notes on Fiume.

The peninsula of Istria splits the Adriatic Gulf at its northern extremity into two parts, in this point somewhat resembling the Red Sea. The north-western or main branch heads in the Gulf of Trieste, whose port is distant some 80 miles by sea. From the southernmost point of the peninsula the eastern bifurcation, which mostly concerns us, extends in a north-easterly direction, forming the Gulf of Quarnero, about 40 miles long; and here, at the northern head, lies the port of Fiume, in N. lat. 45° 19' 19" and E. long. (Gr.) 14° 26' 43, 5". The site is thus S.E. of Trieste, and distant 79 miles by rail, 46 miles by road, and nearly 120 miles by sea.

Fiume is built at the foot of the mountain range trending south-eastwards along the eastern shore of the Adriatic. This offset of the Julian Alps is known under the general and collective geographical name of Dinarian Alps (Dinarisches Gebirge); but its natural form and appearance have given it the popular names Carso, or "Karso" (Karst), and causes this particular part to be known as the "Liburnian Carso" (Liburnische Karst). It is the background of the ancient Liburnian Sea, now the Quarnero Gulf; or, as it was also called, the Sinus Flanaticus, alias Flanonicus, after the Flanates inhabit-

* The origin of the word is disputed. Philostratus trace it to "Hrast," an oak, its principal growth. But the word is considered too modern by the classicists, who would find it in the Celtic *Caer*, a stone, which best describes its surface. Hence, finally, the Carnic tribe and the provincial names, Krain, Carniola (Cragna), and Karinthia. The *Karstgebiet* is divided into the maritime (Seekarst), and the highland. For full particulars see "Das Karstgebiet Militar-Kroatens, &c. Verfasst von Joseph Wessely, &c., Agram, Albrecht, 1876.—R. F. B.

ing its shores; hence, too, the name of their chief port: Flanona (*hod* Fianona), a little Istrian harbour north of the Arsa mouth.

The comitat (county) of Fiume extends over a superficial area of 161,830 hectares (625 square miles), and is bounded by the frontiers of Istria and Carniola on the west and north; and by Croatia and the military frontier on the east and south-east. It embraces the whole sea-coast as far as the port of Novi included. The greater part of the comitat lies on the Carso plateau, between two and three thousand feet above sea-level. From its high and barren plain rise several peaks, such as the Snjesnik (snowy) group (6,000 ft.), on the west, with the Sijeme, the Mlecni, and the Bitoraj ranges (1,600 to 3,000 feet above the plateau) on the east. The surface slopes gently towards the Kulpa (Colapis river) valley on the east, and rapidly seawards, forming three distinct terraces, or platforms, before the shore is reached. This peculiar formation of the range gives a most picturesque appearance to the coast generally, and especially to the town of Fiume, which is built on the hill-side, close to the sea-shore, at the head of the bay.* The latter, seen from the town, looks like a beautiful lake, the front view being closed in by the chain of islands, of which Veglia and Cherso are the principal, whilst on either side the coast land rises to a height ranging between 3,000 and 6,000 feet.

Fiume (river), derives its present Italian name from its situation at the mouth of the Recina torrent, also called the Fiumara,† the only river deserving the denomination which flows into the Quarnero. It is supposed to occupy the site of one of the ancient Liburnian towns, "Tersatica," which was destroyed by Charlemagne (A.D. 799). Fiume was known at a later period by the name of Vitopolis, and still later as (Civita) Sancti Viti ad Flumen, in German, St. Veith am Pflaumb,‡ from which it has inherited its present name.

Of the ancient history of Fiume little or nothing has been preserved, all documents which might have tended to clear up the subject having been burnt by the Venetians, under Angelo Trevisano, in 1509. This much is, however, certain, that the Phoenicians first settled on our shores more than 3,000 years ago, and laid the foundation of commerce with the Mediterranean. They were followed by the Pelasgians, or Pelasgi, one of the earliest tribes that occupied Greece; to them are ascribed the cyclopean structures still found in Greece, Epirus, Italy, and on the western shore of Asia Minor. Their language was the common congener of Greek and Latin; they were an agricultural people, and they possessed considerable knowledge of the useful arts. The Tyrrhenian Pelasgi were, according to Müller, the remnants of the ancient Pelasgi, who preserved their nationality when the great body amalgamated with other tribes. The Etruscans, who succeeded them, were a sub-race of these Tyrrhenian Pelasgi,§ and, with the Rhaetians||, were called Tyrrhenoi and Tyrsenoi by the Greeks, and Tusci or Etrusci by the Romans. They occupied that portion of Italy which is separated from Liguria (the Genoese) by the river Macra (Magra), and from Latium by the Tiber, the greater part of which forms the Tuscany of our day. They became a civilised, polished, and highly prosperous nation; but they fell at last beneath the superior power of Rome,

* The Bay of Fiume is one of the most charming that I have yet seen; and it wants only a Vesuvius to make it a formidable rival to Naples.—R. F. B.

† This south-Italian and Sicilian word properly means a winter-torrent; the Hebrew Nachal opposed to Nahar; the Greek Kheimarrhos; the Arabic Wady; and the Nullah of Hindostan. It is thus improperly applied to the Fiume stream, which flows all the year. Recina in Slav is a small reka (river).—R. F. B.

‡ Pflaumb, again, is not a pure German word, and appears to be a local corruption of "Flumen" or Fiume.—R. F. B.

§ I need hardly warn the reader that the origin of the Etruscans is still *sub jussu* *lis*, and that apparently no two authors agree upon the subject. I see no reason to question their Lydian derivation.—R. F. B.

|| Rhaetia, *i.e.*, part of Tyrol and Switzerland of the present day, of which Tridentinum (Trent) is the principal town, ultimately subdued by Augustus.—R. F. B.

and never recovered their defeat at Lake Vadimonis (Lago di Bassano) by Papirius Cursor, B.C. 310, and subsequently by Cornelius Dolabella, B.C. 283.

The Greek colonies, which established themselves on our shores, and monopolised the commerce for centuries, were at last ousted by the Liburnians, an Illyrian race of great ability and courage, which for a length of time held dominion over the Adriatic Gulf. Liburnia constituted the coast district of Illyria between the rivers Arsia (*hod*. Arsa) and Titius (*hod*. Kerka), which separated it on the north from Istria and on the south from Dalmatia. The Liburnians were celebrated for their skill in navigation, which has been retained to this day by the coast people; they constructed vessels remarkable for swift sailing (*Liburna rates*), and it was to craft of this description that Augustus was mainly indebted for victory at Actium (B.C. 31).

The country was at length subdued by the Roman empire under Augustus, B.C. 28, and the natives were frequently employed at Rome as sedan or litter bearers; the islands off the coast then went by the name of *Liburnides* or *Liburnice Insulae*, and the country was found sub-divided into small self-governing districts, which, continued under the new dominion, were known as "civitates." One of the latter, called, as has been said, after the "Flanates," and bounded by the Arsia on the west, was separated by the Recina (Fiumara) on the east from Croatia; it is mentioned by Strabo and Pliny as the river Eneo.*

There is no doubt that Fiume lies on that part of Liburnian territory known as Civitas Flanates, and everything tends to prove that it is built on the very site occupied by the once famous Tersatica.

After the breaking up of the Gothic Empire, Dalmatia and Istria were occupied by the Byzantine Emperors; the Croats immigrated in the seventh century, and settled in the country lying between the Arsa and the Cettina (the classical Tiliurus), under the supremacy of the Eastern Empire, which administered the seaboard by its own officials. The relative position of Croatia to Byzantium is thus described by Gibbon:—

"The Croats, or Chrobatians, are the descendants of a mighty people, the conquerors and sovereigns of Dalmatia. The maritime cities, and of these the infant republic of Ragusa, implored the aid and instructions of the Byzantine Court; they were advised by the magnanimous Basil to reserve a small acknowledgment of their fidelity to the Roman Empire, and to appease, by an annual tribute, the wrath of these irresistible barbarians. The kingdom of Croatia was shared by eleven zoupan, or feudatory lords, and their united forces were numbered at 60,000 horse and 100,000 foot. A long sea-coast, indented with capacious harbours, covered with a string of islands, and almost in sight of the Italian shores, disposed both the natives and strangers to the practice of navigation. The boats, or brigantines, of the Croats were constructed after the fashion of the old Liburnians; 180 vessels may excite the idea of a respectable navy, but our seamen will smile at the allowance of 10 or 20, or 40 men for each of these ships of war. They were gradually converted to the more honourable service of commerce; yet the Slavonian pirates were still frequent and dangerous; and it was not before the close of the tenth century that the freedom and sovereignty of the Gulf was effectually vindicated by the Venetian republic. The ancestors of these Dalmatian kings were equally removed from the use and abuse of navigation; they dwelt in the White Croatia, in the inland regions of Silesia and Little Poland, 30 days' journey, according to the Greek computation, from the sea of darkness."

When Croatia attained independence in 840, it is uncertain whether the Civitas Flanates belonged to her or not; more probably it remained under the dominion of the Franks, as history shows no trace of a formal transfer. The eastern part of the Civitas Flanates was

* So says the original authority, Dr. Jos. A. Lorenz.—R. F. B.

subsequently granted, in feudal tenure, to the Bishop of Pola, who thus became a vassal of the Patriarch of Aquileja, and, through the latter, of the Holy Roman Empire. This state of ecclesiastical matters continued to the year 1787, although it did not extend to the civil rule.

In 1139 Fiume was granted, in feudal tenure, by the Bishop of Pola to the Counts of Duino, and they retained possession of it till the end of the fourteenth century. At that date the family became extinct, after having transferred its allegiance, in 1372, from the see of Pola to the House of Hapsburg. Fiume, meanwhile, had flourished; the cathedral, restored in a.d. 1200, assumed the title and patronage of *Beatae Virginis Assumptae*. This dignity, according to the fashion of the time, was considered only due to a town of episcopal rank. For 28 years between 1338 and 1365, Fiume was mortgaged to the far-famed Frangipani or "Break-bread" family, when it reverted to the Counts of Duino.

Already, after the peace of Constance, Fiume had received (1183) a free charter, as did most of the towns and the strongholds on the Adriatic, in order better to enable them to withstand the aggression of the Venetians. Subsequently (1399) the town was granted by the House of Hapsburg to Count Rambert de Wallsee, husband of the last scion of the Duino house; and, on the redistribution of the family property in 1464, it fell to Wolfgang de Wallsee, who, in 1471, made it over to the Emperor Frederick III. as a domain of the House of Austria.

From 1471 to 1776 Fiume was administered by Imperial governors, entitled "Vicarii Imperiales," according to her own free charter. When Charles and Ferdinand of Austria divided their inheritance at Worms (1522), Fiume was declared an independent province, and her liberties were confirmed by Ferdinand (1530), under the sanction of her charter, which was revoked only in 1836. The Emperor Maximilian conferred on her (1515), the title of "Fidelissima," and in 1659 she was honoured with a special flag; by the Emperor Leopold. Charles VI. declared her a free port (*porto franco*) in 1723; and under the same reign she was called upon to sign the instrument known in history as the "Pragmatic Sanction." She was incorporated with Croatia in 1776 under the Empress Maria Theresa, but a protest of her "Patrician Council" again took her from Croatia in 1779, and declared her a *corpus separatum* belonging to the Hungarian Crown. On this footing she remained till the year 1809.

Occupied by the French invader at the commencement of the present century, Fiume was re-taken from them in 1813 by the English, who burnt all the goods and the ships, and who thus ruined many of the most opulent and respectable families.*

Fiume fell to the Austrian Government in 1814, and so remained till she was again transferred to Hungary by the Emperor Francis I. in 1822. In 1848, she was occupied by the Croats, and she continued under their administration till 1868, when the differences existing between Austria and Hungary were regulated by the settlement known as the "Ausgleich."

The counter-claim to the possession of Fiume, set up by Hungary and Croatia, led to a somewhat complicated arrangement, which, according to the "Ausgleich," is termed the *Provisorium* or *Interregnum*: by this arrangement the south-western corner of the Comitatus Fiume, including the town and port, was separated from the county, and was made over to Hungarian administration. This territory, which has the form of a triangle, is bounded by the *Recina* (Fiumara) on the east, by the

Istrian frontier on the west, and by the sea southwards, it comprises an area of 1.16 square miles (Austrian), and has a population of about 25,000 inhabitants, the town included. It is administered by a civil governor who holds his appointment from the Hungarian crown; his official title is Royal Governor of Fiume and of the Hungarico-Croatian littoral ("Il Governatore Regio di Fiume e nel Littorale Ungarico-Croato"); and he is likewise the head of the maritime government (Seebehörde, Regio Governo Maritimo), whose functions correspond with the Board of Trade. His jurisdiction extends along the Hungarico-Croatian seaboard, as far as the Dalmatian frontier, including the port of Carlopago, but, as the title implies, only to purely maritime matters and to the superintendence of the harbours.

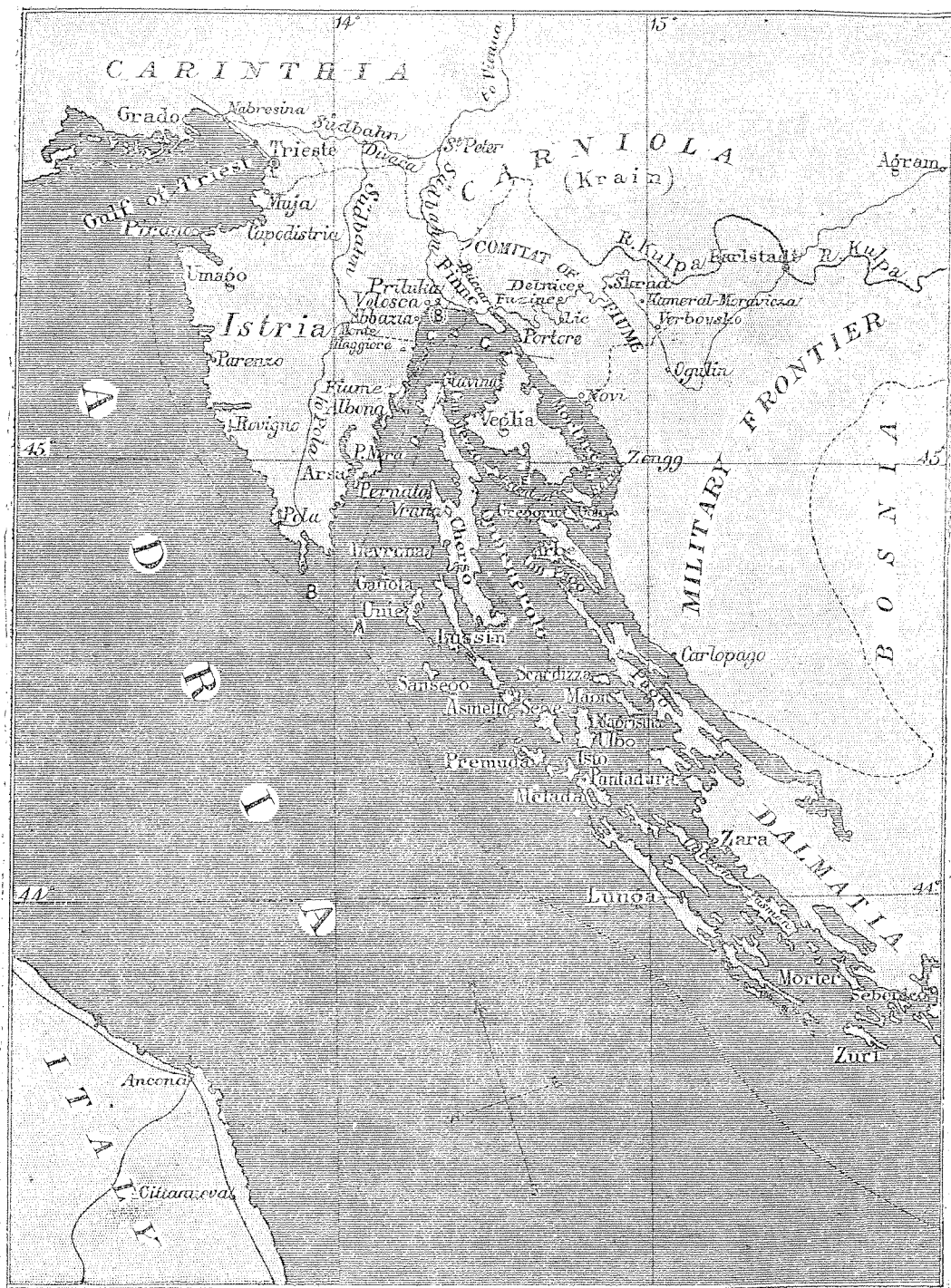
The administration of the maritime region is in the hands of different authorities. The adjoining harbour-town of Buccari, for instance, which lies in the Croatian Comitatus of Fiume, being a free port, is not subject to the Comitatus authorities, but is under the direct administration of the Croatian Government at Agram. In the same way, Segna (Zengg) and Carlopago are governed directly by the officers of the military frontier (*militär-grenz*); and, though the seat is at Agram, the administration is independent of Croatia, receiving its orders direct from Budapest. The smaller ports, Portore, Novi, &c., are under the local authorities within whose jurisdiction they are situated.

Thus we see how complicated is the form of our coast government, and how difficult it has been to reconcile the various interests. The indefinite *Interregnum*, however, is to last until a settlement is come to between the Hungarian and Croatian Diets. The Magyars have their claim to Fiume, on the grant of Maria Theresa, as a "*Separatum sacrae regni coronae adnexum corpus*," The Croats contend that it forms an inseparable part of the Comitatus of Fiume, and, consequently, of Croatia. Considering, however, that, by the present constitution, Croatia stands in the same relation to the Hungarian Crown (*Separatum sacrae regni coronae adnexum corpus*) as that claimed by Hungary over Fiume, the question resolves itself into one of mere form, and, the pretensions of the Magyars having been recognised under existing arrangements, they are content to leave matters as they are. At the same time, they are not likely to waive their rights to, or relax their hold on, a possession of which they have every cause to be justly proud; it is their only seaport, and its situation, which offers every natural advantage, has been poetically termed "the pearl in the crown of St. Stephen."

It is only too true that the Hungarians have hitherto reaped but small profit from this much coveted prize; on the contrary, they have lavished money on their spoilt child without prospect of immediate return. To use a familiar comparison, they have built a stable without providing for the horse; in other words, they have built a railway, which costs £180,000 to £200,000 a year to keep in working order, including interest on capital; they are making a harbour, which is, if the truth be told, hardly wanted;* and which will, when finished, cost little short of a million sterling. Whether the new port may be required hereafter is another question, which need not be considered, the traffic being first to be provided. This should have been the first step, and the money might have been more profitably

* It is not wanted at all; the roads are excellent, and a few simple improvements, such as a floating breakwater of timber, and extended landing quays, with sheds to shelter goods, would have been amply sufficient. But Hungary, the kingdom, must ape Austria the empire; Ireland must do what England does; the poor must rival the rich; and thus Fiume, like Trieste, must build her own expensive and uncalled for new port. It is only fair to own that the Hungarian harbour has avoided the inordinate expense and the inexplicable blunders of the rival "institution" further north; and that if it do no good, it will not, like that of Trieste, severely damage local property, and eventually disturb the position of the town.—R. F. B.

* The English did nothing of the kind, and Fiume would be only too glad, like Lissa and the Islands of Dalmatia, to be once more under the Crown of Great Britain. Professor Lorenz should be ashamed of this assertion in the text. But such is national gratitude. You assist foreign nations, and they hate you; you liberate them, you do what they cannot do, and you arouse their envy, hatred, malice, and all uncharitableness for long generations.—R. F. B.



MAP OF FIUME AND THE QUARNERO.

- A. Town and district of Fiume.
 - B. Extent of Tramontana of Priluka.
 - c-c. Line of section of Quarnero from W to E
 - d-d. Line of section of Quarnero from N to S
 - e-e. Extent of Bora of Zengg.
- } as seen in a separate plan.

spent in taking it. Ports are seldom found wanting, especially upon the East Adriatic coast, when there is trade to attract ships; whilst the finest harbour will not invite vessels where no cargo is to be found. This simple fact has apparently been left out of calculation.

Fiume is represented by a member in the Hungarian Parliament; in ecclesiastical matters she belongs to the diocese of Segna (Zengg), whose resident bishop is subject to the Archepiscopate of the Croatian capital, Agram. A bishop also resides at Veglia, who is subject to the Archbishopric of Zara, in Dalmatia.

The islands in the Quarnero are under the administration of the Istrian Government, with the exception of the south-eastern, or those lying south of Segna, viz.:—Gregorio, Golo, Arbe, and Pago, which belong to the military frontier.

Veglia was the seat of the Frangipani family, descendants of the old Roman consular line, who derived their name from the generous act of "breaking" or dividing, "bread" in time of famine. One of this house, by name Cencis, was guilty of the profane violation of the persons of Pope Gelasius II. and of his College of Cardinals in 1118. The last of the long line was decapitated for rebellion,* together with Count Zriny, Banus of Croatia, on the 30th April, 1671. The traitors' tombstone, in the parish church at Weiner Neustadt, near Vienna, bears the following inscription:—"Hoc in tumulo jacent Comes Petrus Zrinius, Banus Croatiae, et Marchio Franciscus Frangepan, ultimus familiae, qui, quia caecus caecum duxit, ambo in hanc foveam occiderunt. Discite mortales et casu discite nostro observare fidem regibus atque Deo. anno dom. 1671, die 30. Apr. hora nona. Ambitionis meta est tumba."

To the Frangipani family also belonged the castle of Tersato, situated in Croatian territory, close to Fiume, on the other side of the Recina. Now it is the property of the children of F. M. Count Nugent, and contains some objects of interest, amongst others a column erected by Napoleon I. at Marengo.†

Fiume possesses some Roman remains in a well preserved gateway, said to be a triumphal arch of the Emperor Claudius II. The old town walls are also preserved in some places. Above the town are the foundations of an old Roman wall, which crosses the Karst plateau, and which can be traced with intervals as far as Laibach, capital of Carniola.‡ It is said to have been the boundary line between the Eastern and Western Empires, but more probably it formed a line of defence against the inroad of barbarous foes.

SECTION II.—Physical Conditions of Fiume.

Fiume, I have said, is built at the mouth of the Recina, which flows into the Quarnero Gulf, east of the settlement. Although its sources become visible only about 900 ft. above the level of the sea, it is evidently the drain of the wide, barren and storm-wrung plateau. Never dry, even in the height of summer, it offers favourable sites for mills and factories within easy distance, about a mile off the town; 3,000 horse-power and more being available for such purpose. The annual supply is estimated at 850 millions of cubic yards, and the amount of deposit carried into the sea at 600,000 cwt. The latter, by slow degrees, is forming a bar, diverting the course of the stream, on reaching the sea, almost to right angle with the upper line of cliff-bordered bed.

The formation of the Carso prevents the accumulation

of water on the plateau; the average annual rainfall (46 to 48 inches), runs off in the form of torrents to the sea. The average temperature of the water is not more even in summer than 45° to 68° Fahr. The uplands are therefore very badly supplied with the element, excepting in places where rain accumulates in natural reservoirs; these, moreover, are few and far between. The seaward slopes are likewise arid, until close to the shore, where limestone springs appear in abundance, extending along the coast from Fiume eastwards for about 30 miles*. These fountains supply Fiume and the eastern shores of the Quarnero with an abundance of the best drinking water, which, even in the height of summer, never exceeds 50° Fahr. In the town itself are four public springs, besides many private. The west coast of the Adriatic is not so bountifully supplied, and what water there is reaches a temperature of 60° Fahr. Much of the rain falling on the plateau bursts from under the sea. Of this, sufficient proof is afforded, by the low temperature of the Quarnero. In places these springs rise to the surface after heavy rains, with violence enough to endanger small craft; near Moschenizza the torrent re-appears in a circle of 60 yards diameter, and near Ika, in Istria, there is another of smaller extent.†

Another proof of this phenomenon is the Lake of Vrana, Cherso island, which lies in a basin 45 fathoms deep, separated from the sea by a broad ridge, high and stony; it has no apparent affluent or effluent, and the low temperature of the water shows that it flows by some submarine passage from the highest parts of the Istrian Alps; probably from Monte Maggiore itself; the effluent must be of the same character; the level of the lake being 40 feet below sea level.‡

The mountains north of Fiume are scantily wooded, while those to the east and north-east are almost entirely bare, excepting in the few places sheltered from the Bora or north-east wind.§ The vegetation of the western, or Istrian coast is, on the other hand, both abundant, varied, and well worth the botanist's study; it extends down to the sea which, not being subject to the Bora, is milder in winter than the northern and eastern shores of the Quarnero Gulf. It is also cooler in summer, being shaded from the afternoon rays of the sun by the high ridge forming the background. Abbazzia, which lies on the coast at the foot of the Monte Maggiore (4,444 Austrian feet high) has on this, and only on this, account, some claim to be called the Austrian Nice.|| As far as situation, vegetation, and climate are concerned, it bears comparison with the Riviera and with places like San Remo, so much frequented by invalids. Something might be made of the site, if the speculation were properly worked, and a suitable bathing establishment, with accommodation for visitors were provided. At present every comfort is wanting, and there is not sufficient enterprise to take the matter in hand. The bathing is excellent, on a sandy beach, but safety arrangements are requisite, on account of sharks, which of late years have made from time to

* This feature repeats the phenomena of the Colesyrian Valley. The rains fall upon nummulitic and hippuritic rocks, which are crevassed and honey-combed from top to toe; and hence the torrents gush out at the feet of the mountains.—R. F. B.

† The same is the case in the Syrian waters, near the island of Arad. Aradus, Ruad, where the fishermen can bale fresh water out of the salt sea. Doubtless this is the reason why the Quarnero abounds in tunny, which come to bathe in the cooler element; and thus we explain the existence of the huge prawn, *Nephrops norvegicus*, which is found, however, at Nile, at Naples, near the Balearics, and in other parts of the Mediterranean.—R. F. B.

‡ The best proof of its being supplied by a submarine spring or springs, is the fact of its not being salt. I doubt the existence of an effluent; the changes of water-level are very great, and evaporation would readily take the place of an emissary.—R. F. B.

§ The Bora, generally, is rather an east north-easter (Greco levante) than a north-easter, but it ranges to the north north-east, and varies according to the heights and lay of the coast range.—R. F. B.

|| The "Austrian Nice" is more applicable to Gorica, Gorizia, or Görz, in the county of that name, north of Trieste.—R. F. B.

* There are widely differing views concerning the fatal end of this noble house, and perhaps the envy and the jealousy of the ruler equalled, if it did not excel, the ambition of the vassal.—R. F. B.
 † To which, be it said, he had no right whatever. The well-known Count Nugent, an Irishman born, bought the picturesque old castle for a song; and strange tales are current concerning the peculiar way in which he repaired it.—R. F. B.
 ‡ I am not aware that any one has traced it; although there are reports that a section is to be seen near the Castle of Schneeberg, in Krain.—R. F. B.

time, their appearance in the gulf, in pursuit of tunny fish.*

The Croatian Alps, which the railway connecting Fiume with Karlstadt ascends to a height of nearly 3,000 ft., are thickly wooded on the summits; thence, the forests extend as far as the Bosnian frontier, affording an almost inexhaustible wealth of timber, of which Fiume is the natural shipping port; indeed, the chief trade of Fiume is the export of scantling, planks, staves, hoops, &c., and this trade export will be greatly developed when the country is opened up, the demand for timber generally, and especially for staves, being at times almost unlimited.

The Quarnero Gulf is of uniform depth, the bottom forming as nearly as possible a plain; the water varies from 30 to 40 fathoms, and reaches 50 and 60 only in places. The coast, both of the mainland and islands, is precipitous, and forms deep water close in-shore, thus abounding in creeks and bays, where safe refuge and good anchorage grounds are to be found. The tide is almost imperceptible; there is only one flood and ebb in 24 hours, with a rise and fall of 1½ ft. to 2 ft. in calm weather.

The fishery of the Quarnero is excellent, in regard both to quantity and to variety. It is a source of considerable revenue to the coast people; its produce forms their chief diet, and a large export trade of fresh fish, more especially of tunny, is carried on with Trieste and Venice. Salted and preserved fish is likewise exported to more distant places. The "scampo," a delicious kind of crawfish, is caught here, which has the reputation of not being met with elsewhere, excepting in Norway.† It resembles the prawn in taste; it varies from 4 in. to 8 in. in length, sometimes growing even larger; and it is found chiefly in those parts of the sea where fresh water springs abound.

The prevalent winds are the Bora, Scirocco, Tramontana, Provenza, and, in summer, the Maestrale, besides sundry local currents. The Bora is usually described as a north-easter, which blows mostly during winter time, in vehement gusts (*refoli, raffales*) from the Carso, where dense clouds collect; the weather being fine and the sky elsewhere clear, it generally lasts three, nine, or fifteen days. It is not, however, a wind which blows from any given quarter, but varies according to the direction of the mountains, down which it streams at right angles. Thus, along the coast east of Fiume, the mountain chain trends from north-west to south-east, and the Bora blows from north-east. About Segna (Zengg) it becomes an easter, the mountains changing to a due southerly direction, and at some places on the coast it comes from the east south-east. The Bora may, therefore, be described as essentially a land wind, blowing from north north-east, north-east, east north-east, east, and even east south-east. Its chief feature are the vehement gusts, which lash up the sea, and often raise water-spouts, the whole surface of the water being veiled by smoke and sea-dust. It does not extend far from shore, and it is, therefore, in a great degree, local; the western, or Istrian coast, being almost free from it, whilst on the plateau of the Carso it loses all these characteristics, and is nothing but a cold, dry north wind; in fact, the returning Baltic current.‡ It blows on an average three months in the year, one-third of the winter and one-eighth of the summer; during the latter season, however, it becomes a Borina, a reduced copy of the Bora, cool and dry, but not blowing in gusts.

The reverse of the Bora is the Scirocco, or equatorial

* At Trieste, the plague of sharks which, of late years, has greatly increased, is popularly attributed to the opening of the Suez canal.—R. F. B.

† Before noticed. I am glad to hear that Mr. Faber is preparing a detailed account of the fisheries.—R. F. B.

‡ The Adriatic, as the map shows, forks at the northern head like the Red Sea, and the two tepid basins—the Gulf of Trieste and the Quarnero—cause a general and regular rise of the atmosphere. The cold and heavy draught from the mountains rushes in to restore the equilibrium; hence the Bora is felt mostly on the slopes, and the gusts extend but a few miles out to sea.—R. F. B.

current, a warm, damp and unhealthy wind, which rises and falls gradually, and which blows continuously, not in gusts. It invariably brings rain and heavy seas, raising the water as the Bora depresses it.

The Tramontana is a sharp dry blast from the north-western corner of the Gulf; its course being directed by a deflection of the Carso at that point, it seldom extends more than half way across the Gulf. The finest season, from May to August, is that during which this wind blows daily, from daybreak till 8 a.m., and is succeeded in the afternoon by the Maestrale. This is a summer breeze from the north-west: it dies out at sunset and generally gives way to the Borina. When accompanied by the cool morning and evening breezes, it is a sure sign of lasting fine weather; it never exceeds the strength of a fair sailing breeze. The Provenza* is a mild, damp wind, ranging from south-east to south-west. The Libeccio or Gherbin, from the south-west, is rare and never lasts long, although capable of raising the heaviest sea, an accident which does not happen more than once in two or three years; as a rule, it is only a good trade-wind blowing during the summer afternoons, several days in succession, instead of the Maestrale.

Besides these five, there are local winds, as the Borinetta (a reduced Borino); the Forian, a south-easter or east-south-easter, which does not reach the northern coast, and which, although at times violent, never lasts long; the Segna (Zengg) Bora, which is the most violent in the Gulf, blowing down the Vratnik Pass, and rendering the harbour of Segna the most unsafe that can well be imagined. This wind does not reach more than half way across the Gulf, but it has completely wasted the exposed north-eastern and eastern shores of the otherwise fertile island of Veglia.†

Last of all may be mentioned the Tramontana of Priluka, a local norther, which ploughs down a pass in the north-western recess of the Gulf for the greater part of the summer and winter months, during the forenoon, and at times after sunset, more rarely during the whole day. It hardly ever reaches five miles out to sea, or even as far as Fiume.

Great pains have been taken to disparage the Quarnero from a maritime point of view, and also Fiume as a seaport, in favour of Trieste, which has hitherto had all the success, by means of the Südbahn monopoly.‡ But this artificial state cannot last for ever, and the trade, which of right belongs to Fiume, will in due course of time find its natural channel, in spite of all endeavours to the contrary. Indeed the consequences of the favouritism by which the trade of Trieste has, for many years past, been artificially propped up become daily more apparent, by a gradual though constant decline in the returns of that port. Fiume can bear to stand on her own merits from a maritime point of view; she can even claim superiority over Trieste in many respects, if only considered in a fair spirit. It may be well to point out here some of the natural advantages which Fiume possesses. §

1. For vessels coming up the Adriatic Gulf the distance to Fiume is 40 direct miles shorter than to Trieste.

* In Istria "Provenza" is applied to the intervals before the setting in of the Bora or of the Scirocco; and "Contraste" to the contention of the winds when the land is tormented by the Bora, and the sea by the Scirocco simultaneously.—R. F. B.

† There are peculiar points concerning the Bora of Segna which require study. Under the Venetians the place was called "Porto Quieto;" and the admirals declared that want of wind often wasted their time for weeks. The mountains behind the townlet have all been disforested, and perhaps this may be one reason for the inordinate fury of the gale. It appears also to have curious electrical conditions raising the sea surface, as if to meet waterspouts.—R. F. B.

‡ The fault lies with Fiume. Even after she had her own two railway lines, the inveterate apathy and want of commercial enterprise have kept her back, and neglecting the present she will lose the future. As soon as Bosnia and the Herzegovina shall fall into the hands of Austria, the admirable harbours of Dalmatia, the finest in the Mediterranean, will find their proper occupation, and Fiume, which has failed to take time by the forelock, risks a return to her former insignificance.—R. F. B.

§ Fiume in maritimer Beziehung von Heinrich von Littrow. Fiume, 1870.

2. When once the Faresina Channel is passed, between the Island of Cherso and the mainland of Istria, Fiume harbour is accessible in almost any weather; if, however, the passage is prevented by strong headwinds, vessels can find shelter and refuge on either side, with good anchorage-ground in 20 and 30 fathoms, within a few hours' sail from Fiume. For instance, we have the ports of Medolino (for small ships), Arsa, Fianona and Albona (Rabaz), on the Istrian Coast; the large Cherso Bay, the harbour of San Martino on the south-western coast of Cherso, all offering excellent anchorage ground. The Gulf of Trieste affords no protection from the prevalent Bora, and it is not an uncommon occurrence that vessels already in sight of Trieste have been forced to run before the wind, and to seek refuge in the roads of Pirano, or to anchor in the open off Umago, sheltered by the hills of Salvore. Hence again they have to beat a hasty retreat if the wind suddenly veers round to north, and north-west, or to west.

3. The entrance of the Quarnero is throughout of almost uniform depth, and free from sandbanks and reefs on both sides, and, including the Faresina Channel, it offers everywhere good anchorage-ground. The Gulf of Trieste narrows considerably between Pirano and Grado; moreover, many a vessel has stranded on the sandbanks off the latter port, which it has been found necessary to mark by a light ship.

4. The harbour of Trieste forms the only protection from the south-east, south, south-west, and west; whereas nature has provided Fiume with the most effectual protection, by the situation of the islands and the general configuration of the gulf.

5. The new port of Trieste, now in course of construction, affords only doubtful protection, being open to the most violent wind, the Bora (east-north-easter), and partially so to the Scirocco (south-easter). The Fiume harbour will, when completed, protect ships from all winds.

6. The violence of the Bora is much greater at Trieste, and stops all work in the harbour, on an average, 70 days in the year. This is not the case at Fiume, where a day's work is seldom lost.

7. Another great advantage, which the natural situation of Fiume offers, is the number of islands (upwards of 60), by which the coast is studded, and the various channels thus available for reaching the Dalmatian Coast, as far as Sebenico, a distance of about 150 miles, without issuing into the open. This is highly favourable to coasting vessels, not to mention the advantage from a strategical point of view, in times of war and blockade.

SECTION III.—Railways.

In former days, Fiume was all-important as an emporium of the trade of Italy and the East, for the countries lying south of the Danube. Till the end of the seventeenth century she appointed her consuls to Ancona, Civita Vecchia, Messina, and other ports. Under Charles VI. a treaty of commerce was made with the Turks, for the purpose of opening up the eastern trade, Fiume being at the same time declared a free port. An Oriental Company was started, to which a monopoly of commerce with Portugal and the East was granted. About the same time a sugar refinery* was founded by the Dutch, and the protection of the Austrian flag was granted to traders settling at Fiume.

In the year 1768, 82 Greek families sought refuge from Turkish Bosnia, and, citizenship having been granted them by the Empress Maria Theresa, they established a trading company, under a charter accorded by Joseph II. This colony subsequently became very wealthy, and to it are due, in a great degree, the growth and prosperity of the town.

In 1800, under Francis I., the Louisenstrasse, a trunk road 76 miles long, was built, connecting Fiume with

Karlstadt, thereby facilitating the trade with Croatia, Hungary, Slavonia, and Bosnia. At that time the trade was very important, and its decline is owing entirely to the period of innovation, and to the policy under which the building of railways was inaugurated in Austria. For many years Fiume was left out of the question. Under the all-ruling monopoly of the Südbahn, a line has lately been built, connecting Sissek (on the Save) and Agram with Steinbrück, lying on the main line, Vienna to Trieste. Thus, the whole trade, which to that time had concentrated at Fiume, was diverted to Trieste; and thus Fiume, totally disregarded, remained without any railway communication till 1873.

When the dawn of the new constitutional era at last broke upon Hungary (1868), and gave the impulse which aroused the country to remedy the neglect of her national interests during the reign of absolutism, the authorities eagerly undertook the task of filling up gaps in the system of communication; but they did so with an energy hardly commensurate with the resources of the country. Fiume having at the same time been assigned to the Hungarian crown, one of the favourite schemes was establishing direct railway communication with the sea, and thus opening an export trade *viâ* Fiume, then confidently expected to become the successful rival of Trieste. The connection of Fiume by rail with the two nearest points of the existing network of the Südbahn was considered the most rational and inexpensive course; one of the chief features of the scheme being also a plan for the extension of the port. The railway lines in question had already been under consideration, and the tracings, made many years previously, consisted of:—

1. A western line, joining the Südbahn at St. Peter, on the main line, Vienna—Trieste, 44 English miles distant from Trieste, and 35 miles from Fiume.

2. An eastern line, joining the Südbahn, at Karlstadt, 33 miles from Agram, and 109 miles from Fiume.

The concession for the first line was granted to the Südbahn, 5 per cent. interest being guaranteed by the Austrian and Hungarian Governments on the outlay; but the second project, on account of its length and the expense resulting from engineering difficulties, was carried out by Government.

The Fiume-St. Peter line was already under consideration in 1857, but excepting the tracing, nothing was done for more than twelve years, nor was it opened before June 25, 1873. It descends from St. Peter (1,830 Austrian feet above sea-level), through the valley of the Reka, on a gradient varying from 1:500 to a maximum of 1:40; there are two principal and a number of smaller tunnels, one at Maloberze, 1,975 ft. long on a gradient of 1:70, and the other at Rakavac, 1,000 ft. long. The total length of the line is 54½ kilometres, or close upon 35 English miles, consisting of:—

75 curves, measuring	77,830·88	Austrian feet.
rectilinear	94,642·09	„ „
Total ..	172,472·97	„ „
Minimum radius of curves	750	„ „
Average „	1,303	„ „
Average radius of the whole line.....	2,887	„ „
The gradients are:—		
1 in 500 — 1 in 89	70,411·19	
1 in 81	26,992·40	
1 „ 80	11,769·30	
1 „ 60	480	
1 „ 41	5,065	
1 „ 40	37,309·24	
	152,027·13	
Horizontal	20,445·84	
Austrian feet ..	172,472·97	

* The old building, a villa to the north of the town, is still shown.—R. F. B.

The earthworks, embankments, dams, cuttings, &c., are estimated at 2,767,833 cubic metres. The annual goods traffic amounts to about 80,000 tons.

The Karlstadt line, opened in October 1873, is a more considerable work than the St. Peter, on account of its greater ascent (836·2 metres) and other difficulties. One cannot help admiring the way in which the obstacles have been overcome, and how technical science has contrived to construct an efficient working line, with due regard to economy. These results have been attained by the rare combination of ingenious tracing, and by the boldness which characterises the whole works. Starting from Karlstadt the line crosses the Dugadruga (valley) by an embankment,* measuring 70,000 cubic metres; it then passes the Kulpa by a 3 R. span iron bridge (middle arch = 39·6 metres, 2 sides, each 32 metres), and the torrent Globornica by a viaduct 29 metres high (middle span 24 metres, and 2 side spans each 20 metres). Two embankments, one in the Bistrica valley (140,000 cubic metres), and the other at Touin (120,000 cubic metres) lead to the Ogulin station. From that point the following works are noticed:—1. A single-arched iron bridge over the Dobra (28·6 metres); 2. The double track tunnel of Ticeva (168 metres); and 3. The double track tunnel of Gomirze (230 metres). Thence (4) crossing the Dobra a second time by a single span iron bridge (28·6 metres), are 4 tunnels with double tracks near Verbovsko (134 metres, 70 metres, 43 metres, 60 metres); 5. Third iron bridge across the Dobra (23·6 metres); and 6. A fourth similar (28·6 metres) over the same river, till Cameral Moravice is reached. Here finishes the valley line, the maximum ascent having been hitherto 1 : 143, from this point the mountains have to be assailed, and the gradient increases to 1 : 60. Leaving Skrad, the following works are passed:—1. The Kupjak tunnel (1,245 metres), and dam (220,000 cubic metres); 2. The Susica tunnel (367 metres); 3. The Besnyak tunnel (168 metres), passing the stations Delnice and Lokve, and reaching, 4, the tunnel (274 metres), which traverses the mountain Slene, this being the highest point of the line, 836·2 metres above the level of the Adriatic.

The descent now begins on an increased gradient of 1 : 40, crossing the Licanka by a double-span iron bridge 24 metres high, each span measuring 35 metres. Thence reaching the station, Fuzine, the gradient decreases to 1 : 60, as far as Lic, 816 metres above the sea, which station is reached after passing the tunnel of Kobiljak (521 metres). From Lic the gradient again increases to 1 : 40, and passing the station Zlobin, and a cutting in the mountain Obesenjak (90,000 cubic metres), the line reaches the station Plase in a southerly direction; thence turning north north-east, it skirts Mount Sveto and makes Meje, the station. After this it again bends round to south south-east, and running along an embankment (160,000 cubic metres) arrives at the Buccari station.

Here the line crosses the Draga valley by an embankment (210,000 cubic metres), passes Mount St. Anna by a cutting (95,000 cubic metres) and after another embankment at Podvezica (170,000 cubic metres) reaches the coast on the edge of the foot hills, which it descends till the terminus. The Recina (Fiumara) valley is crossed by a viaduct twelve metres high, five arches each measuring seven metres, and one arch of two metres, with an iron bridge across the river, spanning 35 metres. From this point Fiume is reached, after passing through a double track tunnel 417 metres long.

The whole line is constructed for a single track, with the exception of a few tunnels specially mentioned; they have been so laid out that a double line may be added.

The gradients are as follows, starting from Karlstadt:—

		Metres.				
		Ascent.		Descent.		
1 in 2,000	—	1 in 500	..	4,606·97	..	250·
1 in 500	—	1 in 200	..	16,278·34	..	2,997·02
1 in 200	—	1 in 100	..	43,245·24	..	1,106·55
		1 in 66 $\frac{2}{3}$	..	136·06	..	140·
		1 in 62 $\frac{1}{2}$	..	28,950·42	..	—
		1 in 59	..	—	..	50·
		1 in 55	..	—	..	403·63
		1 in 50	..	—	..	937·17
		1 in 47	..	—	..	960·
		1 in 40	..	—	..	35,093·84

Ascent, 93,217·03 metres; descent, 41,938·21; horizontal, 40,015·13; total, 175,170·37 = 108·78 English miles.

The average gradient of the descent to Fiume is therefore somewhat over 1·50; the minimum radius of curves is 275 metres, and the stone and earthworks of the whole line are set down at 7 millions of cubic metres. The cost of construction amounted to about 28 million florins (£2,333,000). In comparison with this outlay, an annual goods traffic of some 70,000 tons, on a daily average 20 vans, each loading 10 tons, must appear disproportionately small to the most casual observer. It is hardly to be wondered at that the line does not pay even its working expenses, especially as on one of this description, the wear and tear of the rolling stock is much more considerable than is the case of ordinary railroads.

I will now endeavour to point out the cause of this failure, and at the same time to seek the remedy.

When our double-line of rail was opened, Fiume was, and is still, dependent upon the following principal railways connecting her with the Hungarian interior, viz:—

1. St. Peter, Pragerhof-Budapest, 375 English miles, belonging to the Südbahn.

2. Fiume-Karlstadt, 109 miles; Karlstadt-Agram, 33 miles; Agram-Zakany, 63; Zakany-Budapest, 155; total, 360.

Now the two lines, Fiume-Karlstadt, and Agram-Zakany (172 miles), belong to the Hungarian States railways, and the remaining 188 miles to the Südbahn.

3. Fiume-Agram-Sissek, 173 miles, of which the line, Fiume-Karlstadt (109 miles), belongs to the State railways, and the remaining 64 miles to the Südbahn.

4. Fiume-Zakany-Esseg, 334 miles, of which the lines, Fiume-Karlstadt, and Agram-Zakany (172 miles), belong to the States railways, and the remaining 162 miles to the Südbahn.

Thus we see that all these systems are owned more or less by the Südbahn. No. 1, over its whole course; No. 2, over 188 miles; No. 3, over 64 miles; and No. 4, over 162 miles. The "Great Southern" can therefore dictate, as far as suits its own interests, what terms it likes with regard to the Fiume traffic. As a matter of fact, the chief exports and imports from the east (Sissek, Esseg, &c.) are still diverted by preferential tariffs to Trieste; similar and other means, such as vexatious regulations with regard to the re-loading of goods passing off their own lines and on to the States railways, control effectually enough the traffic to Fiume by the Karlstadt line, and turn it in favour of the longer line, *via* St. Peter, which is entirely in the hands of the Südbahn. It is clear that Fiume has not benefited by railway communication to the extent that might have been anticipated under ordinary circumstances, and that it is entirely dependent upon, and at the mercy of, the Südbahn, whose sole interest it is to favour Trieste.

This is, however, a state of things which might, and which ought to have been foreseen, and opposed by the Government before going to the expense of building the line to Karlstadt. It has, on the contrary, played into the hands of the Südbahn, by consolidating and increasing the value of its network.*

* This part of Austria is the classical land of huge and wasteful embankments, which ought to have been viaducts; and that near Fiume is one of the worst of its kind. By way of rendering it more dangerous, in a place where the Bora blows furiously, it is provided with a sharp curve.—R. F. B.

* What can Governments do in these days, when the whole power of finance and capital is brought to bear upon them? Enough to say, that the house of Rothschild rules the Südbahn.—R. F. B.

What is most needed is the opening up of the so-called frontier railways (*Grenzbahnen*) along Bosnia, and forming a continuation of the line Fiume—Karlstadt to Essegg, on the Drau, by way of Sissek. It is needless to point out the importance of this line, not only to Fiume in particular, but also to the general trade of Hungary; the fact is generally admitted by all who can speak with authority on the subject. It would bring Fiume within 276 English miles of Essegg, or some 60 miles nearer than by the present roundabout way *via* Zakany; and this important centre is situated on the Drau, close to its confluence with the Danube, where the bulk of the trade with Servia and Slavonia is concentrated. Thence railway communication is already established with Zombor, and the Francis Canal system, and Szegedin, in the heart of the Banat, the "granary of Hungary;" the distance from Essegg to Szegedin being 104 miles. The latter place would not be more than 380 miles distant from Fiume, and the whole line would be independent of the Südbahn.

The first tracing of the frontier works dates as far back as the year 1845, thus showing the importance which even then was attached to them; and, curiously enough, they were sanctioned by the Hungarian Parliament in 1870. Notwithstanding this, Government has not thought fit to carry out the project, a neglect the more surprising, considering that, in a financial point of view, the cost would be covered by the proceeds of the frontier state-forests, which have relatively no value, until this road is built. The opposition which the opening of the line meets at head-quarters may be partly due to strategical reasons; the more obvious causes are partly the all-powerful influence of the Südbahn, whose interest it is to prevent competition, and mainly the centralisation policy which has guided the Hungarian Government in all railway matters. The object is to make the Danube the highway of the commerce with the East, and Budapest the emporium and the central point, whence the trade of Hungary and of all its railways is to radiate.

Thus, whilst opposing the frontier lines, Government has been anxious to secure a railway from Budapest along the left bank of the Danube, to Zombor and Neusatz, where, crossing the Danube, it will be continued to Semlin, and there will effect a junction with the contemplated Servian lines. There is no doubt that this route must be considered in many respects strategical, but one of its chief objects manifestly is to attract the trade of the lower Danube, of Turkey, and of the East to Budapest, in view of the junction with the Servian lines and the short sea route *via* Salonica. Hence Government is anxious to see the plan carried out, despite the financial difficulties and the problematic success of the scheme, whilst the frontier lines are doomed to delay. The question is of the greatest importance at a time when its solution is so intimately connected with the great military and political question of the day.

In the present state of affairs the Budapest-Semlin scheme has been shelved, pending more favourable circumstances, both political and financial, and it is impossible to say whether or not the frontier lines will, meanwhile, remain on paper. It is, however, to be hoped that Government may relinquish a policy so dubious as that of trying to impose a given channel on trade, and of refusing to carry out a measure acknowledged by the sanction of Parliament to be of prime importance, affording a short and natural outlet for exports to reach the sea.

Presently, the all-dominant influence of the Südbahn will have to be dealt with, and a settlement of this question arrived at, as soon as the carrying out of the frontier lines is determined. Thus, Sissek must be looked upon as an important junction, owing to its position on the River Save, the chief, and, at present, only channel for the Bosnian trade, and will become even of greater value, as the nearest junction point with the Bosnian railways now in course of construction, and terminating at Salonica. In this respect the prolongation of the line

Fiume-Karlstadt to Sissek would be of primary importance to Fiume, were it not for the fact that the position is already held by the Südbahn. Thus we explain how the trade is now diverted from Sissek, *via* Agram and Steinbrück, to Trieste. On the same principle it would still be so diverted, even if the line Karlstadt-Sissek were built, although Fiume would then lie some 54 miles nearer to Sissek than Trieste does. The Hungarian Government also refuses its sanction to the junction of the Hungarian with the Bosnian lines (which would be effected at the frontier town of Novi, by the construction of a line, Sissek-*Novi*) as long as the position of the Südbahn continues to form an *imperium in imperio*. The former justly fears that the traffic with the East would be diverted by the Südbahn to Vienna, to the exclusion of Budapest. This is a further reason for Government favouring the junction with the Servian railways, by means of the Budapest-Semlin line, in preference to the junction with the Bosnian lines at Novi, which is naturally favoured by the Viennese authorities, including the Südbahn.

The only course calculated to remedy the present intolerable state of things would be for Hungary to buy up, or to rent, at fixed annual payments, the network of the Südbahn in Hungary, in the same way as was lately done by the Italian Government in respect to the Lombardo-Venetian lines of the same company. Thus the obnoxious monopoly would, at a single stroke, once and for ever, be abolished.* Our Government recognises the necessity of some such radical measure, and this will probably be one of the first financial railway problems which will have to be solved, as soon as political and economical circumstances permit its being discussed with a chance of success. The sale of the Lombardo-Venetian lines to Italy was effected on the basis of an annuity payable to the Company according to its revenue for 1875, and it amounted to 29½ million francs in gold (£1,130,000), besides which the Company received 127 millions francs cash (£5,080,000), and the rolling stock was taken over at a valuation.

The sale having been proposed for the ratification by the Austrian and Hungarian Governments combined, the Südbahn being formally an Austro-Hungarian Company, the consent of the Hungarians was granted, under the reserve, that they should consequently acquire the right of purchasing on similar terms the Hungarian lines of the Südbahn. The Hungarian network, a total length of 98½ German (= 459 English) miles cost the Company 66 millions florins; but the purchase on the basis of the sale to Italy would involve a State outlay of at least 80 millions (£6,666,000), or an annuity of six millions (£500,000). It is, however, probable that the financial position of the Südbahn may tend to facilitate the necessary agreement. Whilst pointing out what has become a measure of prime necessity from the Hungarian point of view, the Government should be warned at the same time against the error of an extensive policy in favour of what it considers national interests. The wisdom of this system lies open to the same grave doubts as the present policy of the Südbahn monopoly, which it is so anxious to displace. What is to be feared is, that, the independence of the Südbahn once removed, much as the step would benefit Fiume, it will make way only to a greater monopoly on the part of the State, a monopoly upheld by preferential tariffs, in order to favour a circuitous route *via* Budapest. Such a course would, doubtless, favour individual interests, but it would be unjustifiable from the point of view of all recognised principles of political economy. The irretrievably bad effects of a combined policy of centralisation and of trade-protection are so generally admitted in our days, that it would be mere presumption to enlarge upon them.

It will be interesting, as indeed, it is indispensable, in order to substantiate these arguments, to give a few

* Meanwhile, where is the money to come from?—R. P. B.

figures as to the relative position of Fiume and Trieste. The distances are as follows:—

	Kilometres.
Trieste-Pragerhof-Budapest.....	618
Fiume-Zakany-Budapest.....	579
Trieste-Steinbrück-Sissek.....	337
Fiume-Agram-Sissek.....	279
Trieste-Pragerhof-Essegg.....	603
Fiume-Zakany-Essegg.....	538

Taking the uniform rate of a penny per ton per English mile, this gives an advantage in favour of Fiume over Trieste of, 2s. per ton to Budapest; 3s. per ton *via* Agram to Sissek and 3s. 6d. per ton *via* Zakany to Essegg; an advantage which is obviated at present by the preferential tariffs of the Südbahn. If the frontier lines were carried out, the advantage in favour of Fiume would increase to 8s. 4d. per ton to Essegg, and 4s. 7d. per ton to Sissek; thus showing the importance of these lines, not only to Fiume, but to the general trade of lower Hungary, and proving that the Südbahn has a direct interest in opposing their construction.

The following figures show the desolate state of the Karlstadt - Fiume, and the Agram - Zakany railways from a financial point of view. The total length of the two lines is 279·15 kilometres, at an outlay to the state of 37 million florins, which involves an annual charge of 2,220,000 florins. The working of the lines gives the following results:—

	1876. Florins.	1875. Florins.	Difference. Florins.
Gross receipts ..	709,054	803,329	— 94,275
<i>i.e.</i> , per kilometre ..	2,540	2,877	— 337
Gross expenses ..	922,550	838,446	+ 84,104
<i>i.e.</i> , per kilometre ..	3,305	3,004	+ 301
Loss on working ..	213,496	35,117	+ 178,379
<i>i.e.</i> , per kilometre ..	760	126	+ 634

The regulation of the River Kulpa is the first measure required in order to feed the Karlstadt-Fiume line. It might be carried out at a comparatively small cost, especially if combined with the organisation of the chain-navigation system, which does away with the necessity of locks, requiring only a small depth of water, and which can be carried on, as actual trial has shown, at minimum rates of freight. The distance from Semlin to Karlstadt by the Save and the Kulpa being 730 kilometres, the cost of organising chain-navigation along the whole route, including 13 stations, and as many steam-tugs, might be effected at £250,000; and the freightage, based upon the experience afforded by other rivers, would not exceed, for the whole distance, 16 kreutzers per cwt., or 5s. 4d. per ton.

This would be a boon for the raw produce of Bosnia, of Servia, and of Southern Hungary, including the timber of the military frontier. An annual goods-traffic not exceeding 300,000 tons, by no means an exaggerated estimate of what might be expected, would not only make the concern itself pay, but also would enable the Karlstadt-Fiume Railway and the Fiume harbour works to make some returns upon outlay.

To be continued.

CORRESPONDENCE.

KOENIG AND APPUNN.

In the *Journal of the Society of Arts* for 3rd August, p. 864, there was inserted a long letter from me respecting the discrepancy between Koenig's and Appunn's determinations of musical pitch, and I concluded by saying that I found the necessity of further examination, and would communicate the results.

During the whole month of September, I was diligently occupied in examining Appunn's tonometer, with the aid of a ship chronometer, rated to lose one second in twenty-four hours. The result was a conviction that Koenig's

objections were groundless, that the instrument had been correctly tuned, and that the beats had been properly counted.

It remained to account for the discrepancy between the results obtained from two different tonometers by Dr. Preyer, of Jena, and by myself (which are practically identical), and those obtained by Prof. Mayer and McLeod, and quite recently by Lord Rayleigh (which agree with Koenig's very closely). I had devised a series of experiments for this purpose; but, as they required the use of two separate tonometers, and two different and distinct blow-tables, a considerable delay ensued before I could commence them. To-day, for the first time, I experimented on two such tonometers for four hours, with the following important and rather unforeseen results, which must be taken as preliminary and very rough, requiring confirmation and correction by the whole series of experiments, which will occupy me for several weeks, as they are of a very laborious and tedious nature.

By taking the beats between two reeds in the same and two reeds in different tonometers, and combining them properly, it appears that the confined space of air in which the reeds beat, affects the number of the beats produced, and accelerates them, so that about one per cent. more beats are produced in a given time than would be heard if the beats took place in an open space.

If this result is confirmed, Appunn's numbers will have to be reduced by about one per cent., and this will make them very nearly agree with Koenig's. The tables, therefore, on pitch which I gave in my paper of 25th May, will require correction. As I have made arrangements for receiving copies of the forks measured for the French commission, I shall be able to measure them myself by Appunn's scale, and give them in the corrected form. I hope to present the corrected table to the Society of Arts at the end of the coming session. In the meantime I hasten to give the above important and novel acoustical result, which, while it reconciles apparently irreconcilable statements, in nowise impugns the accuracy of the workmanship of Appunn and Koenig, or of the other observers.

ALEX. J. ELLIS.

25, Argyl-road, Kensington, W.,
November 3rd, 1877.

MEETINGS FOR THE ENSUING WEEK.

- MON.... Institute of Surveyors, 12, Great George-street, S.W., 8 p.m. Opening Address by the President, Mr. E. J. Smith.
- Royal Geographical Society, University of London, Burlington-gardens, W., 8½ p.m. 1. The President's Opening Address. 2. M. Broyon, "Mirambo's description of Unyamwezi, and the Best Route thither from the East Coast of Africa."
- TUES... Civil Engineers, 25, Great George-street, Westminster, S.W., 8 p.m. Mr. Alfred Holt, "Review of the Progress of Steam Shipping during the last Quarter of a Century."
- Anthropological Institute, 4, St. Martin's-place, W.C., 8 p.m. 1. Mr. H. H. Howorth, "The Spread of the Slaves" (Part I.) 2. Capt. R. F. Burton, "Mori Castelli."
- WED.... Society of Public Analysts, Burlington-house, W., 8 p.m. 1. Mr. J. Carter Bell, "Milk Analysis." 2. Mr. Otto Hehner, "The Analyses of Five Mineral Waters."
- THUR.... Linnæan, Burlington House, W., 8 p.m. 1. Mr. B. McLachlan, "Report on the Insecta collected by Capt. Feilden and Mr. Hart during the Recent Arctic Expedition." 2. Dr. Edward L. Moss, "The Surface Fauna of the Arctic Seas as observed in the Recent Arctic Expedition." 3. Dr. W. C. McIntosh, "The Annelids of the English North Polar Expedition (1875-76)." 4. Mr. Charles Stewart, "Certain Organs of the *Cidaris*." Chemical, Burlington House, W., 8 p.m. 1. Prof. Odling, "Gallium." 2. Dr. Wright and Mr. Luff, "First Report of the Chemical Society on some Points of Chemical Dynamics." 3. Mr. M. M. P. Muir, "The Influences Exerted by Time and Mass in Certain Reactions in which Insoluble Salts are Produced." 4. Mr. C. T. Kingzett and Dr. Paul, "Two Fatty Acids of the Series C_nH_{2n}O₂."
- South London Photographic (at the HOUSE OF THE SOCIETY OF ARTS), 7.30 p.m. Popular Meeting.
- SAT..... Working Men's Club and Institute Union (at the HOUSE OF THE SOCIETY OF ARTS), 4 p.m.

The Second Course will be on "The Application of Photography to the Production of Printing Surfaces and Pictures in Pigment," by THOMAS BOLAS, Esq., F.C.S., and the Third Course on "Some Researches on Putrefactive Changes, and their Results in relation to the Preservation of Animal Substances," by B. W. RICHARDSON, Esq., M.D., F.R.S.

ADDITIONAL LECTURES.

A Course of Three Lectures, on "Explosions in Coal Mines," will be delivered by T. WILLS, Esq., F.C.S., on the three following Monday evenings, at eight o'clock, January 28th, February 4th, and February 11th.

LECTURE I.—JANUARY 28TH.

The nature of the Coal Measures. Mining for coal. Ventilation of mines. Composition of coal. Occurrence of fire-damp or marsh gas in mines. Nature and properties of fire-damp. Dangers connected with its presence.

LECTURE II.—FEBRUARY 4TH.

After-damp or choke-damp. Methods adopted to allow of safe working in fiery mines. Various appliances for lighting mines. The nature of the safety lamp. Different forms of this lamp.

LECTURE III.—FEBRUARY 11TH.

Connection of the variations of atmospheric pressure with explosions in coal mines. Dangers attending blasting operations in coal mines. Action of coal-dust in certain classes of explosions. The use of the safety lamp as an indicator of the presence of fire-damp, also as a means for its quantitative estimation.

JUVENILE LECTURES.

A short Course of Two Lectures, suitable for a juvenile audience, will be delivered during the Christmas holidays, by Prof. BARFF, M.A., on "Coal and its Components." Special tickets will be issued for these lectures.

AFRICAN SECTION.

Meetings of this Section will be held on Tuesday evenings, at eight o'clock.

CHEMICAL SECTION.

Meetings of this Section will be held on Thursday evenings at eight o'clock.

INDIAN SECTION.

Meetings of this Section will be held on Friday evenings, at eight o'clock.

Papers to be read in the above Sections will be announced in the *Journal*.

ADMISSION TO MEETINGS.

Members have the right of attending the above

meetings and lectures. They require no tickets (except for the Juvenile Lectures), but are admitted on signing their names. Every member can admit two friends to the Ordinary and Sectional Meetings, and one friend to the Cantor Lectures. Books of tickets for the purpose have been issued to the Members, but admission can also be obtained on the personal introduction of a Member.

MISCELLANEOUS.

FIUME AND HER NEW PORT.

By George L. Faber,

H.B.M. Vice - Consul at Fiume.

(Continued from p. 1038.)

SECTION IV.—*Harbour Works.*

A plan of Fiume, dating 1670, shows the town surrounded by walls, forming a limited quadrangle, whose two sea-facing sides, eastern and southern, were subtended by a moat, apparently fed by the Recina river, flowing on the east of the settlement, and entering the sea to the west. These curtains were strengthened by bastions, of which the strongest was on the shore, and their remains are still visible at the upper end of the town. The limits of the old walls on the sea side are shown by the gateway, now turned into a clock-tower. It is distant some 250 yards from the present quay, and this reclaimed space now forms part of the modern town. The only accommodation for shipping in the ancient plan is apparently a wooden pier, some 20 or 30 yards long; at that time Fiume was an open roadstead. The first approach to a harbour was the mouth of the Fiumara, the course of the river having been purposely changed by providing a shorter outlet eastwards. Its original bed was deepened, and supplied with quays and a dam seawards; thus it afforded some accommodation for coasting vessels and small craft, by which it is still used. The extension of trade, however, called forth greater requirements, and the commencement of the present harbour was inaugurated by the Archduke Palatine Stephen, in the year 1847. The new structure consisted of a breakwater, 269·7 metres long, and 5 metres broad, extending from east to west by north; the shore quays formed a rectangle, each side measuring 180 metres, and the landing pier (Molo Adamich)* extended from the shore facing the breakwater to a length of 70 metres by 20 broad. The area of the harbour covered 12½ acres.

This accommodation has hitherto met the requirements of trade, but in the year 1868, under the new régime, it was thought necessary to follow the example of Trieste, and to provide a larger harbour, with a superficies of 80 acres. The plan was to be carried out by lengthening the breakwater (*diga* or *hafendamm*) to 1,170 metres, thus giving it a total of 1,441·7. The plan shows it inclining slightly seawards for the first 770 metres, and thence running parallel with the sea-shore for the remaining 670. It was further proposed to extend and regulate the shore side of the harbour, which at that time measured only 180 metres facing the breakwater. This was to be effected by building quays to a total length of 936 metres, with two moles (landing-piers), marked in the plan Nos. 1 and 2, each 150 metres long, by 80 broad, while the third or outer mole (No. 3) was to run 210 metres by 36. The harbour entrance was to be formed by this last mole (*Abschluss mole*), and

* So called from one of the worthies of Fiume, to whose exertions the modern town owes most of its improvements.—R. F. B.

by a spur pierlet, disposed at right angles, extending 250 metres from the outer end of the breakwater, and leaving a ship passage of 100 metres. This plan afforded four basins for the accommodation of shipping, the total length of the harbour being about 1,180 metres, and the breadth between quay and breakwater 385 metres at the outer end, narrowing to 300 metres in the middle, and to 180 metres at the inner end. The space between the breakwater and the ends of the moles, Nos. 1 and 2, measured 175 metres and 235 metres respectively. The dimensions of the four basins, exclusive of the space between the pier ends and the breakwater, may be given as follows:—Inner basin (old harbour), 150 metres by 140 metres; 2nd basin, 280 metres by 150; 3rd basin, 250 metres by 150; and outer basin, 250 metres by 180.

The extent of quay and pier accommodation for the loading and unloading of vessels, exclusive of the breakwater, thus represents an aggregate length of 2,200 metres and more. This plan was worked out by M. Pasqual, chief engineer of the Marseille harbour, who was also engaged upon the Trieste harbour works. The details and estimates were taken in hand by Government, and the latter were provisionally set down at 13 millions of florins (about £1,100,000). A portion of this work, consisting of 800 metres of the breakwater of the quays extending as far as mole No. 2 (not included); and, lastly mole No. 1 (*Molo Zichy*), was given to the "Entreprise générale de Chemins de Fer et Travaux Publics," a French Company, which took the contract for the sum of 5,016,973 florins (about £420,000). The work comprised in this section has proceeded satisfactorily. Meanwhile, and fortunately before the original form of the plan had been further developed, the authorities could not help recognising, while financial difficulties afforded a convenient pretext, the fact that the great expectations of Fiume had, at all events, in as far as her immediate future is concerned, been highly exaggerated. This consideration rendered unadvisable the immediate outlay of the whole estimate; and presently it led to a modification of the original plan. The Government, about the middle of last year, resolved to adopt more modest proportions, and these are still more than adequate for present requirements, whilst they can be increased to the original extent whenever circumstances may demand. The reduced scale on which these important and admirably executed works are now being carried out will, when completed, contain a superficial area of 57½ acres. Mole No. 1 (*Molo Zichy*) will be built as originally planned, and a second, or outer mole (*Abschluss Molo*), 150 metres by 40, will take the place of mole No. 2 (original plan), while the breakwater (*Hafendamm*) will be limited to the 800 metres already provided for in the provisional contract. The modified estimates were thus reduced by nearly one half, or to 6,876,504 florins. This sum included about 800,000 florins for the necessary harbour-fittings and appliances, which were not inserted in the original estimates; such as a lighthouse at the port entrance (100,000 florins); steam tug for harbour service (40,000 florins); a floating fire engine (8,000 florins), a *sanità*, or quarantine-house (2,000 florins); an astronomical clock and midday-signal (4,000 florins), 9 buoys with Mitchell screws, and 12 buoys on the chain system (together 198,000 florins). The preference was given, although more expensive than the moveable cranes, of which, also, a smaller number would have sufficed, to fixed hydraulic cranes, on account of their greater safety from fire. Besides the six fixed hydraulic cranes (88,910 florins) there will be a floating crane of 30 tons lifting power (30,000 florins), a running crane (4,000 florins), and a small crane for petroleum (800 florins). Lastly, the railway accommodation on the quays is laid down at 85,500 florins. The works are to be completed by the end of 1879,* and with these appliances ships of 1,200 to 1,500 tons will be unloaded in three days.

The harbour will then consist of three basins, viz. :— (1) The inner basin, or old harbour, with quay and pier accommodation of 430 metres in length, and an area of 21,000 square metres; (2) the middle basin, with quay and pier accommodation of 580 metres, and an area of 42,000 square metres; (3) the outer basin, with quay and pier accommodation of 550 metres, and an area of 37,500 square metres. The total length of the quay and pier accommodation is thus 1,560 metres, the area of the three basins measures 100,500 square metres (against 230,000 square metres of the whole harbour), and thus 100 large vessels can be accommodated.

The harbour works are being carried out by the French company, under the direction of M. Sivel, and the immediate supervision of the Hungarian Ministry of Public Works, represented by their engineers, Messrs. Eisinger and Pünkösti. To the latter gentleman I am chiefly indebted for the information here given.

The first step was to find suitable quarries within easy reach; and this was not a difficult matter, as hard nummulitic limestone forms the Carso. A convenient site was fixed upon at Martinschizza, in a small bay some four miles distant on the eastern coast, inclosed by rocky hills of the required material. The analysis of this rock is:—

Carbonate of lime	92.5
Oxide of iron and clay	5.
Carbonate of magnesia	1.5
Insoluble	1.
	100
Specific gravity	2.7
Hardness	2.9

The principal quarry lies at the bottom of the bay, and the barges are loaded by means of a wooden pier 225 metres long, whose end is 1,000 metres from the furthest part of the quarry. Appleby cranes (eight horse-power) lift the blocks and load the trucks, which have to pass over the scale, and which are worked to and fro by means of two locomotives. As a rule, 550 trucks full of material are worked per diem, and this number increases to 700 during summer. The 17 barges for rubble, with flap-doors, are 23 metres long by 6½ broad, and have a loading capacity of 160 tons. There are also 20 barges of peculiar construction, which will presently be described. Their loading capacity ranges from 180 to 280 tons, and they transport the stone to Fiume, the service being carried on by five steam tugs.

On an average 800 labourers are employed on these works. The dimensions of the stone are of three sizes:—

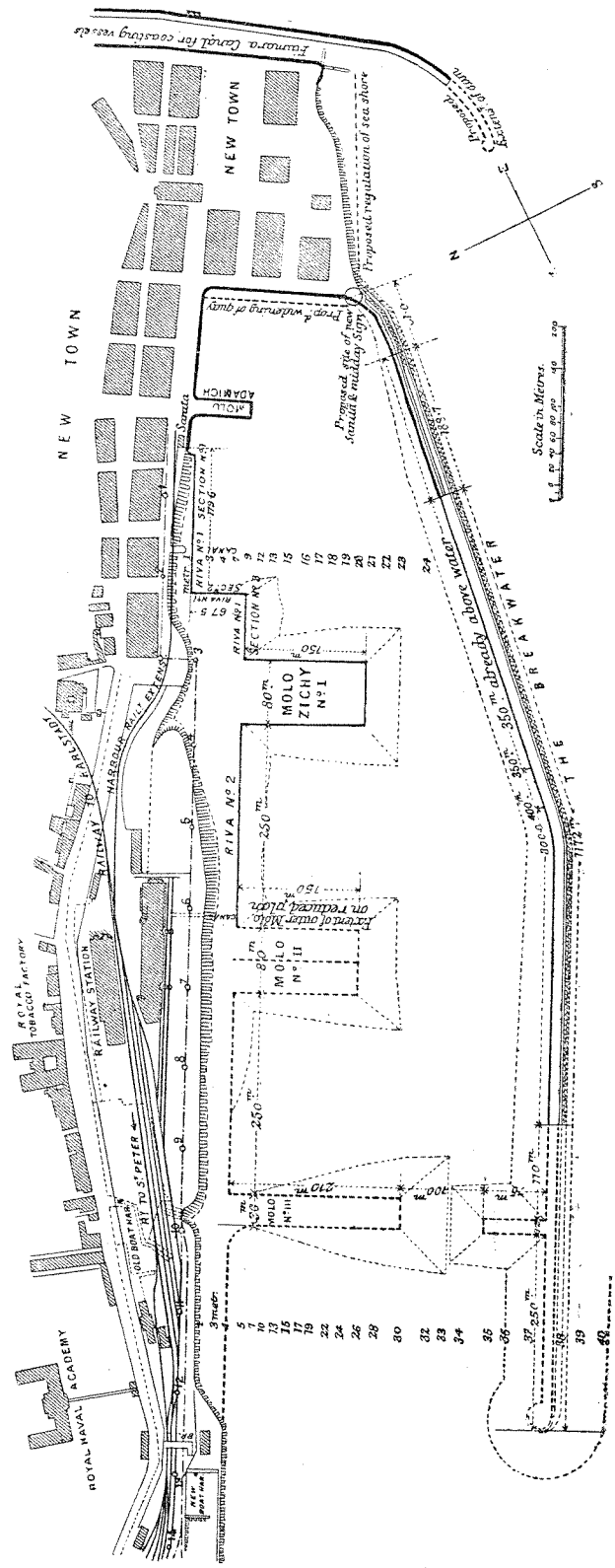
No. 1 weighs	2— 26 cwt.
" 2 "	26— 80 "
" 3 "	80—180 "

A cubic metre of the nummulitic rock weighs 52 cwts., and of rubble 33 cwts. The average cost of working the rock, including the blasting, and all the labour till sunk in the harbour, is 1 florin 60, or 2s. 8d. per cubic metre.

A new quarry has now been opened outside the bay, close to the sea shore, and the work is carried on entirely by manual labour, there being insufficient space for mechanical appliances. There the rock is less mixed with earth than in the original quarry, and there is accordingly less waste of labour. The blasting is done by common gunpowder, and its effect is found to be less damaging to the rock than dynamite. Ignition is effected by a Brequet electro-magnetic battery, which has never yet failed to work, in combination with a peculiar and a novel kind of fuse.

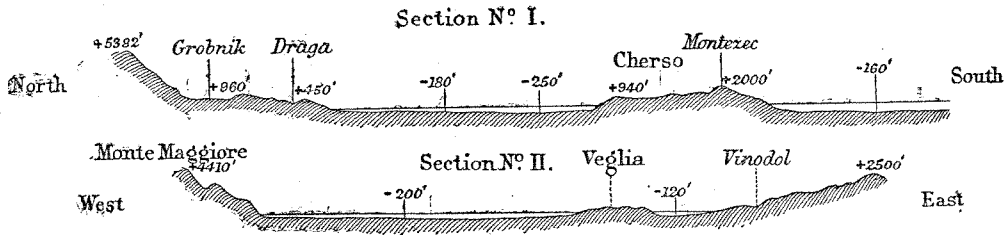
On an average 4,500 tons are sunk per diem in the harbour. The operation is as follows:—The *envrochement*, or supporting base, is made with rubble in pieces not under 6 lb., and ranging to 2 cwts. in weight. The slope is 1 in 2 in the piers, and 2 in 3 in the breakwater; this angle has been found sufficient, and has required

* I cannot see the least prospect of this being done before 1880.—R. F. B.

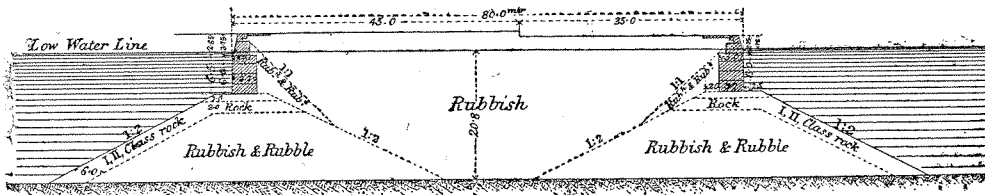


PLAN OF THE NEW PORT OF FIUME.

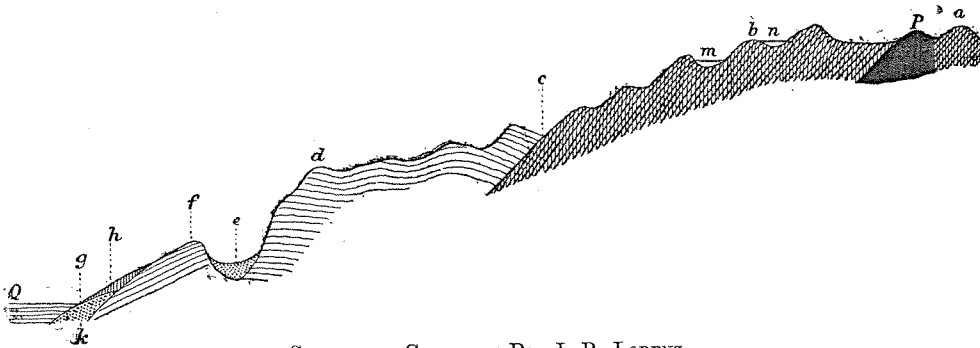
- Extent of old harbour
- Work included in contract
- Extent of original plan
- The numbers show the depth of water in metres.



SECTION NO. I OF QUARNERO, FROM NORTH TO SOUTH; SECTION NO. II OF QUARNERO, FROM WEST TO EAST; SHOWING HEIGHT OF COASTLAND (+) AND DEPTH OF WATER (-) IN AUSTRIAN FEET, ACCORDING TO DR. J. R. LORENZ.

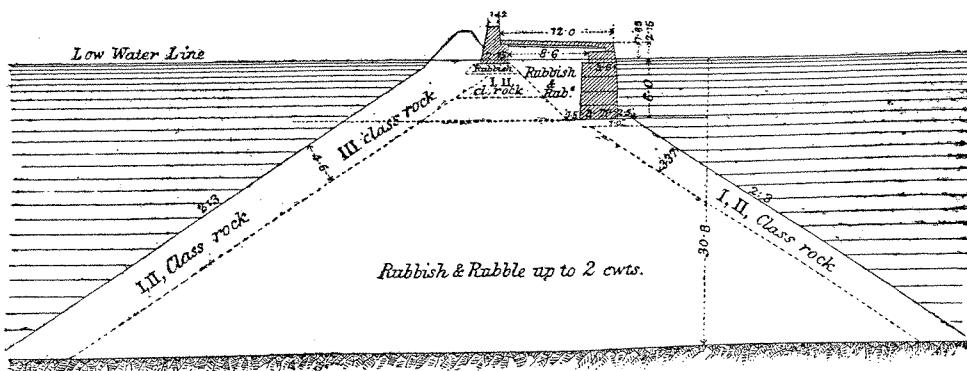


SECTION OF MOLO NO. I (MOLO ZICHY). DIMENSIONS IN METRES.



SECTION OF CARSO, BY DR. J. R. LORENZ.

a-b, plateau; b-c, upper slope; c-d, middle slope; d-e-f, valley gap; f-g, lower slope; Q, Quarnero; a-b-c, tertiary formation; P, volcanic deposit near Fuzine; m-n, local diluvium; c-d-f, limestone; e and k, nummulitic sandstone (*tassello*); h, nummulitic lime.



SECTION OF BREAKWATER. DIMENSIONS IN METRES.

no change. At Trieste, it was necessary to increase it to 1 in 4, on account of the treacherous, muddy ground, which would not retain the stone: the same cause also necessitated much dredging there, whereas at Fiume it was possible altogether to dispense with the costly and dilatory work. The base, when formed, is revetted on the waterside with a layer of blocks, varying in thickness from 3 to 5 metres; in the quays, moles, and inner, or harbour side of the breakwater, these blocks are of the 1st and 2nd category, ranging in weight up to 4 tons. The outer side of the breakwater is covered with blocks of the 1st and 2nd classes to within 10 metres of the water line. The crest is formed by the heaviest blocks, weighing from 4 to 10 tons, extending from 10 metres below to 4 metres above the water line, on a level with the outside wall of the breakwater. When the base is finished, six months are allowed for settling and consolidation; these amount to 1·20 metres before the artificial blocks are laid, 1 metre afterwards, and 0·20 metres in consequence of the superstructure, making altogether 2½ metres to be allowed for. When the foundation is sufficiently secure, and is laid level with small rubble and concrete, the artificial blocks are built up into a wall four tiers high, forming the base of the quays. The superstructure is then provisionally weighted with two additional tiers of artificial blocks (*Belastungsblöcke*) rising above water, and they are left *in situ* about six months, in order to consolidate the whole mass.

The artificial blocks are built up with the normal limestone and Santorin earth. The dimensions are:—Length, 3·70 metres; breadth, 2 metres; height, 1·50 metres; cubic contents, 11·1 metres; weight, 22½ tons. Each block is provided with two grooves, which serve to swing it; and the total cost, when sunk in the harbour, is 120 florins. Altogether, 3,600 are required by the provisional contract, and of these about 1,800 have already been placed in position, about 600 remaining on stock. The Santorin earth—used in the blocks, and generally on the whole works—is a natural cement, imported from that island. It costs only 20 shillings per ton: it is preferred to Portland and other cements, and it has hitherto been found to answer all requirements. It requires more time to dry than the Portland, but it offers the advantage of not having to be used immediately the concrete is made, and also of hardening when submerged. It takes a minimum of 30 days to attain the proper degree of hardness, and the artificial blocks are not moved before they are at least three months old.*

When the weighting blocks (*Belastungsblöcke*), have done their duty, they are removed, and the work can be brought to an end—

1. By filling up with rubble (*remblai*).
2. By building the superstructure above water.

The operations above described have hitherto proved successful, with one exception, *viz.*, on quay (Riva) No 1, section No. 3. In this case the foundation gave way along the whole extent of 80 metres, after the weighting blocks had been placed *in situ*; and one morning the whole structure bodily disappeared, the artificial blocks having imbedded themselves in the ground, under the rock layer, sunk for their support. By this mishap 120 sank, and settled in all kinds of positions, except horizontal. The danger is now being obviated by substituting for the parapet of artificial blocks, a concrete wall of Santorin earth; it is built in caissons, after sufficient time has been given for the sunken mass to settle properly; and the foundation is further strengthened seawards by natural blocks. The success of these measures are chiefly due to the binding property of santorin earth under water, even when placed in contact with old masonry. The depth of this concrete wall varies from two to eight metres, thus showing how uneven is the surface under water which it became necessary to fill up. This part

* The mixture used as cement is composed of 10½ parts santorin earth, 4 parts lime, 1 part sand: the concrete is made of equal arts of cement and gravel.

of the concrete requires at least 900 cubic metres, of which about 600 are completed.

The French Company began operations on December 18th, 1872. Its contract comprises about 3,200,000 tons of material sunk under water (*enrochement*), and 550,000 tons are required for filling up (*remblai* or *terrassement*), besides the artificial blocks, and the superstructure.

A statement is appended, showing the state of the works at the end of March, 1877; it is based upon the accounts kept between the Company and the Government, and settled monthly.

The material is first weighed on the trucks at Martinschizza, and then in the barges, each of which is fitted with a gauge to test its load. By this means a double check is kept; and the Company is paid according to a fixed scale of prices on the material delivered from month to month, a certain per-centage being retained as caution money. The following is the scale of prices:—

120	florins (£10)	artificial blocks.
0·76	"	(1s. 3d.) per ton rubble.
1·40	"	(2s. 4d.) per ton rock No. I.
1·60	"	(2s. 8d.) per ton rock No. II.
1·80	"	(3s. 0d.) per ton rock No. III.
40	"	(66s. 8d.) per cubic metre for cut stone blocks for the superstructure.
65	"	(108s. 4d.) per cubic metre for steps of cut stone.

The present state of the works may be described as follows:—Breakwater. The old Diga, which had a length of 269·7 metres has been widened from 5 to 12; and it is now being raised 1 metre, in order to bring it up to a uniform height of 1·65 metres above low water. Of the 800 metres forming the continuation of the breakwater, one-half is completed under water, and the artificial blocks are laid and weighted up to within 50 yards of that point; the remaining 50 yards will be finished by the end of the present year, leaving 400 metres to be done by the end of 1879. Of these 400 the submarine part has been taken in hand for some time past. The great depth of water (26·30 metres) renders progress necessarily slow. Moreover, it must be considered that the basement of this structure measures 120 metres in breadth, and that the amount of stone required under water only, amounts to 2½ millions of tons. Seawards, the breakwater is protected by a stone parapet, and outermost by large rough blocks of the third class.

The landing platform for goods, measuring 12 metres, is provided with metal rings, and with stout posts for making fast cables. When completed, a double line of rails will be laid, in communication with the railway station, extending all round the harbour quays.

Riva No. 1 extends from Molo Adamich to Molo Zichy, and comprises three sections; No. 1, 179·6 metres; No. 2, 67·5 metres; and No. 3, 80 metres (*vide plan*.) Of these the first section is finished, as well as the greater part of the second. The former is already in use for large steamers, of which two can be along the first section broadside on. The completion of sections two and three, retarded by the accident already alluded to, will probably be brought to an end about the close of this year.

Mole No. 1 (Zichy).—About 83 per cent. of the *enrochement* under water, and some 75 per cent. of the *remblai* are completed; the quay walls of artificial blocks are now being laid by degrees, as the foundation settles sufficiently, and they will then be weighted by the *Belastungsblöcke* when the filling in can be completed. The base of this structure requires 440,000 tons of stuff, and the stuffing 241,000 tons.

When this pier is completed, large bonded warehouses, one for and by the Austro-Hungarian Lloyd's Steamship Company, will be built upon it. Government will also raise warehouses or iron sheds, estimated to cost 100,000 florins (£8,000).

Riva (quay) No. 2, extending between Mole No. 1 and Mole No. 2, and measuring 250 metres, comprises 84,000 tons of *enrochement*, of which only 45 per cent. is done; and 300,000 tons of filling, of which two thirds are completed; ten per cent. of the artificial blocks are also laid.

The construction of the outer pier (*Abschluss Molo*) has not yet been definitely decided upon; at all events it is not put up to contract; probably it will be built before long, the only question being whether a dry dock, which is more needed, ought not to be built first. The estimated cost of the outer mole would be 800,000 florins (£66,666).

Besides these main works, several of minor importance are either completed or projected. For instance, a small boat harbour for the Naval Academy, finished last year, cost 50,000 florins (£4,200); the improvement of the sea-shore, fronting the railway station, between the boat harbour of the Naval Academy and Mole No. 3, ending in 1875, cost 118,000 florins (£9,800).

Finally, among the works still contemplated may be mentioned:—

1. Widening by 10 metres the quay of the old harbour, which runs parallel with the piers.
2. Raising to 1.65 metres the Molo Adamich, which is now only 1.35 metres above low water line; estimate, 16,000 florins (£1,333).
3. Improvement of the sea shore between the harbour and the Fiumara mouth, where a quay is proposed, measuring 260 metres.
4. Lengthening the dam of the Fiumara canal by 100 metres; the estimates for the two latter (Nos. 3 and 4) being 186,000 florins (£15,500).

SECTION V.—*Industrial Establishments.*

A few words remain to be said on the industrial establishment of Fiume, foremost amongst which must be mentioned the fish-torpedo factory of Mr. Robert Whitehead, and the paper-mill of Messrs. Smith and Meynier. The latter is worked partly by water, and disposes altogether of 850 horse power. The annual exports of paper amount to upwards of 30,000 cwts.

Further may be mentioned the royal tobacco factory, employing upwards of 3,000 hands, and turning out upwards of 200 million cigars and cigarettes, besides smoking tobacco. The consumption amounts to upwards of 12,000 cwts. Virginia, 8,000 cwts. Turkish,* and 16,000 cwts. Hungarian leaf; the steam flour-mill turning out upwards of 15,000 tons annually, consuming of late years almost exclusively Danubian and Russian wheat, instead of Hungarian, thus showing the anomalous state of present circumstances; and the chemical factory, producing chiefly sulphuric acid and sulphate of soda, of which 1,600 tons are annually made. Besides these may be mentioned several ship-building establishments, which launch from 15 to 30 vessels annually, mostly of about 600 tons burden. There are also several tanneries and rope manufactories.

SECTION VI.—*Concluding.*

From these pages it may be seen that Fiume, in many points of view, may lay claims to consideration, and even to distinction; that something has been and is still being done by the present administration, and that much more is wanted, in order to secure for it that prominence and pre-eminence in the world's trade which its splendid natural position demands. If success has hitherto fallen short of expectation, the failure is due only to the optimism of those who based all their hopes upon a harbour and a railway; and, although so much remains to be done, success, in course of time, will not be wanting if the authorities and the citizens will come to a sense of what is required, in order to consolidate the rough work whose foundations, as I have shown, have been laid.

After the utter neglect to which the interests of

Fiume had for so many years been subjected, it was hardly to be expected that the settled channel of trade could change in a day, and still less so when the work began at the wrong end, a fact which, I think, is now denied by none. Still wanted, above all, is an earnest, disinterested, and patriotic co-operation of public and private interests; but this is impossible so long as both are ruled by a despotic monopoly like the Südbahn.

Such a monopoly, if justifiable in any way, can be so only in the hands of the State where the lieges would have a claim and a right to insist upon the Government carrying out the works required for the general good. As the matter now stands, private enterprise is crippled on the one hand, whilst on the other, every effort of the authorities is paralysed under the effects of the monopoly. By doing away with it altogether, private enterprise would be stimulated instead of being checked, and what benefits individuals would eventually benefit the State. This much-desired object once attained, and the frontier-railways at the same time taken in hand, so as to bring Fiume into direct communication with Slavonia and with lower Hungary, success cannot be wanting, and the step will redound not less to the interest of Hungary generally, than to the benefit of Fiume in particular. But the change can be brought about only at the sacrifice of centralisation, that mistaken idea which now guides the policy of Hungary. It is full time, after the dearly-bought experience of the last five or six years, to recognise the fact that Hungary's sole chance of successfully competing with America, with Russia, and with India in the trade of cereals, is by forestalling these most dangerous rivals in the markets of the world. This she is able to do, if all unnecessary expenditure and loss of time are avoided in the transit to the coast. Fiume should look forward to this, nor should she rest satisfied till the measures in question are triumphantly carried out.

APPENDIX II.

Supplementary Estimates.

	Florins.
Estimates, as per statement	5,016,973
Outer mole	800,000
Projected works in the Fiumara canal ..	186,000
" " on Molo Adamich	16,000
Lighthouse	100,000
Sanità	2,000
Midday sign	4,000
Steam-tug for harbour work	40,000
Steam-pump (fire-engine)	8,000
Nine buoys with Mitchell screws	} 198,000.
Twelve buoys with chains	
Six hydraulic cranes and machine-house	88,910
Petroleum crane	800
Shifting crane	4,000
Floating crane (30 tons)	30,000
Warehouses on Molo No. 1	100,000
Rails on quays and breakwater	85,500
Contingencies	196,321
Total	6,876,504

NOTES.

According to a recent report of the Under Secretary of State in the Hungarian Ministry of Public Works, M. Von Hieronimy, the length of Hungarian railways in operation in the year 1867, was 295 German (1,375 English) miles. The length of railways constructed between the years 1867-1876 consisted of 574 German (2,675 English) miles, so that at the end of the year 1876 altogether 869 German (4,050 English) miles of railway were in operation in the kingdom of Hungary.

Of the lines built from 1867-1876, the concession for twelve was granted under State guarantee of a sum of 16,205,156 florins per annum; the length of these twelve.

* So-called, I should add.—R. F. B.

APPENDIX I.
Statement showing the progress of the *Tinno Harbour-works on the 31st March, 1877.*

Description of Work.	Stone work of basement under water.		Filling, or "remblai," above water.		Parapet wall.	Stonemasonry with cut stone facings.		Masonry for fixing posts for Cut stone facings.		Posts for making fast.	Flag-stones and stone stairs		Artificial blocks, cubic metres.		Santolin concrete, cubic metres.		Pavement, square metres.		Dredging, cubic metres.		Wood and iron work, in cubic metres and cwt.		Estimates in Florins. Amount paid for work done. Percentage of estimates.		Total.	
	Estimate	Delivered	Per cent. done	50 Kilos.		50 Kilos.	Cubic metres.	Cubic metres.	Cubic metres.		Cubic metres.	Square metres.	No.	Cubic metres.	Cubic metres.	Cubic metres.	Cubic metres.	Cubic metres.	Cubic metres.	Cubic metres.	Cubic metres.	Cubic metres.	Cubic metres.	Cubic metres.		Cubic metres.	Florins.	Florins.
I. Lengthening the Breakwater	Estimate	50,285,230	..	..	6,447.60	4,004.28	281.60	1,171.44	32	672.04	17,760.00	2,695.68	8,367.20	..	..	..	..	..	..	..	..	..	..	3,303,319	3,303,319
	Delivered	36,213,663	..	..	533.36	365.74	4.48	125.08	..	30.99	6,279.00	19.33	..	..	..	..	..	..	..	..	..	..	..	1,683,050	..
	Per cent. done	72.01	..	..	8.27	9.13	1.59	10.68	..	4.61	35.35	0.71	..	..	..	..	..	..	..	..	..	..	..	50.95	..
II. Molo Zichy	Estimate	8,773,350	4,820,000	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	776,466	776,466
	Delivered	7,282,791	3,614,043	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	490,115	..
	Per cent. done	83.01	74.97	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	63.12	..
III. Quay (Riva) No. I.	Estimate	689,650	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	229,398	229,398
	Delivered	475,486	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	174,235	..
	Per cent. done	68.94	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	75.95	..
IV. Quay (Riva) No. II.	Estimate	1,678,550	6,000,000	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	352,973	352,973
	Delivered	756,406	4,007,292	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	163,336	..
	Per cent. done	45.06	66.78	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	46.27	..
V. Widening of old breakwater	Estimate	1,224,306	8,925	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	194,601	194,601
	Delivered	1,071,657	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	126,302	..
	Per cent. done	87.53	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	64.90	..
VI. Boat-harbour	Estimate	50,291	50,291
	Delivered	75.34	..
	Per cent. done	75.34	..
VII. Protection of shore between boat-harbour and Molo III.	Estimate	97,758	97,758
	Delivered	86,828	86,828
	Per cent. done	88.81	..
VIII. Protection of shore between boat-harbour & rly. station	Estimate	20,324	20,324
	Delivered	23,167	23,167
	Per cent. done	114	..

Totals—Estimates, 5,016,973 florins; amount paid for work done, 2,797,318 florins; per-centage, 55.75.

lines being 388·11 German (1,808·59 English) miles, the average guarantee per mile being 42,000 florins per German, or £900 per English mile. The net income of these lines amounted to 2,165,168 florins in 1875 (5,578 florins per German, or £120 per English mile) thus leaving a deficit, as against the Government guarantee, of 14,039,988 florins (or 36,175 florins per German, or £780 per English mile). The gross annual income of the Hungarian network of the Südbahn is given at 70,000 to 75,000 florins, per German, *i.e.*, £1,600 per English mile; and that of the Fiume-Karlstadt and Agram-Zakany lines, belonging to the State, at about 20,000 florins per German, or £360 per English mile.

At present (October, 1877) grain is going forward in large quantities to England from Trieste, the whole of which comes from Hungary, via Pragerhof and Steinbrück, and would in due order of things be shipped at Fiume, were it not for the advantages held out for Trieste shipments by the Südbahn.

I am much indebted, and feel bound to express my thanks to the Ministerialrath, Mr. H. von Catinelli, for a variety of information which, as chief of the Maritime Department (*Seebehörde*), he has placed at my disposal, and for the unvaried kindness with which he is ever ready to oblige all applicants.

RHEEA FIBRE.*

In 1870 the Government of India offered a prize of £5,000 to the inventor of the best machine or process for the preparation of the fibre of the *Böhmia nivea* (popularly known under the names of Rhea, Ramie, and China grass), and the terms on which machines would be admitted to competition were widely notified in India, in Europe, and in America. Many persons declared their intention to compete, but ultimately only one machine was actually brought to the place of trial. The machine having been carefully tested at Saháranpur in the autumn of 1872, was found imperfect in some important respects, and the inventor was adjudged not entitled to the full reward. He was, however, presented with £1,500 in consideration of the partial measure of success he had attained after great perseverance.

2. This machine has not since been adapted by the inventor to practical use, and no improved process of preparing the fibre of the rhea has been yet discovered by other persons. Meanwhile the demand for rhea continues, and the conditions which induced the Government of India in 1870 to offer a prize remain substantially unchanged.

3. His Honour the President in Council, therefore, considers that it is desirable to renew the offer, and it is accordingly hereby notified that a reward of fifty thousand rupees will be paid to the inventor of the best machine or process which will separate the bark and fibre from the stem, and the fibre from the bark, of the *Böhmia nivea*.

4. A smaller reward, not exceeding ten thousand rupees, will be given to the inventor of the next best machine or process, provided it is adjudged to possess merit, and to be capable without difficulty of adaptation to practical use.

5. What is required is a machine or process capable of producing, by animal, water, or steam power, a ton of dressed fibre of a quality which shall average in value not less than £45 per ton in the English market, at a total cost, including all processes of preparation and all needful allowance for wear and tear, of not more than £15 per ton, laid down at any port of shipment in India, and £30 in England, after payment of

all the charges usual in trade before goods reach the hands of the manufacturer. The processes of preparation are to be understood to include all the operations required subsequent to the cutting of the stems from the plants in the field, until the fibre is in a condition fit to be packed for conveyance to the market.

6. The machinery employed must be simple, strong, durable, and inexpensive, and should be suited for erection in the plantations where the rhea is grown. It must be adapted for treatment of the fresh stems, as cut from the plant. The treatment of dried stems offers certain difficulties, and the fibre prepared from them must, moreover, always be much more costly than the fibre produced from green stems. Except during the hot dry weather preceding the rains in Upper India (where rhea grows best), it is very difficult so to dry the stems that no fermentation or mildew shall occur. But during this season the stems are comparatively short, and the crop poor and stunted, unless it is artificially irrigated, and such irrigation greatly increases the cost of cultivation. In the rainy season the plant is in fine condition, but at this season it is almost impossible to dry the stems in quantity without injuring the fibre, unless recourse is had to artificial means of desiccation, which greatly increase the cost of the material. It is, therefore, obvious that the attention of inventors should be given to the discovery of a process for the treatment of the green stems.

7. The trials will be held at Saháranpur, in the North-Western Provinces, in the months of August and September, 1879. Machines entered for competition should be placed *in situ* and be ready for work not later than the 15th August, the competition commencing on the next day. The judges will be appointed by the Government, and they will watch the whole of the trials. But the machines shall be worked and adjusted by the competitors themselves, and no person shall touch a machine without the consent of the inventor.

8. The Government of India will provide proper shelter and accommodation at Saháranpur for all the competing machines as well as the motive power required. It will also pay for the transport from the sea-coast to Saháranpur of all machines up to the limit of one ton each, the freight on any excess weight to be defrayed by the owners. The present rate of freight by rail from Calcutta to Saháranpur is Rs. 3·10 per maund, or Rs. 98·11 per ton, and from Bombay to Saháranpur Rs. 4·1 per maund, or Rs. 110·9 per ton. A free second-class ticket to Saháranpur will also be given to any person in charge of a machine.

9. The owner or owners of the successful machine or machines shall not be entitled to receive the reward offered, except on the following conditions, viz:—

(1.) That a complete technical description of the machine, illustrated by plans drawn to scale, shall be prepared and published (Government paying the cost) for the information of the public.

(2.) That after the expiry of three years from the date on which the award is made, the public shall have the right of manufacturing similar machines, on payment to the owner of a royalty of 10 per cent. on the cost of each machine so manufactured.

10. All persons desiring to compete, under the terms and on the conditions specified above, are requested to make known their intention not later than the 31st December, 1878, giving the following particulars:—

1. Name in full, and residence.
2. Profession or occupation.
3. Number of different kinds of machines entered for competition.
4. Brief description of each machine.

Intending competitors will, at the same time, declare themselves bound (under penalty of disqualification of the competing machines and forfeiture of all claim to the Government reward) to conform to all rules which may be prescribed by Government in connection with the conduct of the trials.

* Notification issued by the Government of India, Department of Revenue, Agriculture, and Commerce.—Fibres and Silk.—Dated Simla, the 31st August, 1877, No. 45.