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## THE ACTIVITY OF SWISS ENGINEERING OFFICES ABROAD

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In the technical field, Switzerland down through the years has acquired a first-rate international reputation for the quality of her work. People all over the world swear by Swiss watchmaking products and precision instruments as well as the machinery manufactured by Switzerland's engineering industry: electrical engines, alternators, turbines, measuring instruments, weaving looms, etc. These products are exported to all countries and the label "Made in Switzerland" is rightly considered a guarantee of quality. Although poor in natural resources, Switzerland has attained a high degree of technical development thanks to the quality of her skilled labour force. Her technicians are famed for their professional conscience and the precision of their work. They owe this reputation among other things to the excellent training they receive in the Engineering Schools of Zurich and Lausanne and in numerous technical institutes in countries known for the value of the courses they offer. In this way a tradition of quality has grown up, largely responsible for the reputation Swiss engineers enjoy abroad.

Alongside the technical staffs in industry, going in for the manufacture and sale of apparatuses and machinery, there is a whole category of engineers and technicians in Switzerland working in engineering offices carrying out the drawing up of plans and the construction of engineering works, especially in regard to roads and railways, bridges, tunnels, dams, electric power stations, high tension lines, water supply, etc. These engineering offices have made an important contribution to the development of their own country by laying the necessary foundations for its economic development. We are thinking in particular of all the hydro-electric engineering works that have been constructed to ensure the country's supply of electricity. These works frequently include spectacular feats of engineering, which have contributed not a little to making Swiss engineering known abroad. Who, for example, has not heard of the Grande-Dixence dam, the highest of its kind in the world? Of Mauvoisin, one of the largest vault-type dams in the world? Of Göscheneralp, the highest earth dam in Europe? In the field of big tunnels, mention may be made of the Simplon and Gotthard tunnels, which were built at the turn of the century and played a leading role in the establishment of the big European railway networks.

In Switzerland, these engineers are continuing their efforts today by undertaking new projects. A big network of motorways will soon link all the big centres of the country not only to each other but to the main highways

of neighbouring countries. The relief of the country necessitates the construction of a great many works of engineering: bridges, viaducts and tunnels. Not only in the plain but also in the mountains new roads are being built. Tunnels are being bored to make it possible to cross the Alps during the winter when the pass roads are blocked by snow. Thus, for example, the new Great St. Bernard motorway, which is partly covered and culminates at its highest point in a  $3\frac{1}{2}$ -mile long tunnel, allows vehicles to cross the Alps between Switzerland and Italy all the year round. In the east of the country, the 4-mile long San Bernardino Alpine tunnel will fulfil a similar function. Its special ventilation system allows for a capacity of 1,500 vehicles an hour.

The harnessing of the country's hydro-electric resources goes on apace. The construction of dams and earthworks has to a certain extent become a speciality of Swiss engineers, who in the course of the years have perfected remarkably advanced methods of calculation and construction techniques. The 377 foot high Mattmark earth dam, for example, work on which started in 1962, is made entirely of morainic material resting on a layer of alluvia over 300 feet deep rendered impervious to infiltrations by a special process consisting of a series of three injections.

In addition to the hydraulic projects, many power stations are being planned, for the country's hydro-electric potential will soon be completely developed. Pipelines are being built to bring petrol direct from the seaports.

The construction of aerial cableways for the transport of passengers or material, is another Swiss speciality, which is once again accounted for by the mountainous nature of the country. There is hardly a valley in Switzerland which is not equipped with such a means of transport.

In view of the nature of their work and local needs, most Swiss engineering offices for many years confined their activity almost exclusively to their own country. Certain big firms however very early on undertook to carry out projects for other countries. Very frequently too, the fame of a certain professor or consulting engineer rapidly spread beyond the frontiers and foreign firms or governments would ask him to help plan a project or give his expert opinion.

Since the end of the second world war, the situation has developed very quickly. Thanks to the progress in means of transport and communications, the relations between countries have been greatly simplified and intensified. In addition, many countries in the process of development, not yet possessing the necessary technical personnel or experts of their own, have had recourse to

the assistance of more industrialized countries to help them lay the foundations on which to build a prosperous economy. It was therefore quite natural that Swiss engineering offices should take part in the planning and execution of such projects. Furthermore, as Switzerland has practically exhausted her own hydro-electric possibilities and possesses a great number of specialists in this field, it is understandable that she should place them at the disposal of countries whose development is less advanced and whose needs are greater.

It is not surprising therefore that, during the last few years, schemes have been studied in almost all parts of the world by Swiss engineering offices: dams, electric power stations, irrigation schemes, canals, ports, industrial establishments, bridges, roads, tunnels, etc. In a great number of these projects, Swiss offices have carried out all the necessary studies and surveys, from the preliminary stage of general planning, the analysis of the economic, technical and financial criteria, the drawing up of a development programme, the drafting of preliminary projects, the comparison of variants, up to the preparation of the final project and actual working plans, the supervision of the construction and putting the plant into operation.

A complete list of the projects handled by Swiss engineering offices in other countries would be far too long. We shall content ourselves with mentioning below some of the most important work carried out during the last few years, so as to give an idea of their geographic distribution.

High fall hydro-electric schemes have been carried out in the Andes: on the Rio Blanco in the valley of the Aconcagua in Chile and on the Rio Rimac and Rio Sta Eulalia in Peru. On the other side of the South-American continent, a low fall hydro-electric power station with an output of 400,000 kW is at present in the process of construction on the Rio Paranaíba in Brazil. Further south, in Uruguay, an electricity works has been constructed at water level at Baygorria on the Rio Negro. In North America, a Swiss engineering office in collaboration with a Canadian office has carried out a general survey for the harnessing of the resources of the Homathko basin in British Columbia. The same group has drawn up the plans for Georgia's gas turbine power station on Vancouver Island.

In Africa, mention should be made of the buttress dam at Ben-Metir in Tunis, the gravity dam at Mechra-Homadi in Morocco and the vault dam at Delcommune in Katanga. In the Sudan, an electric power station has been built at Sennar, on the Blue Nile, and an already existing power station at Burri has been expanded; these two power stations have been connected by 175 miles of high tension cables including several substations. In Nigeria, a project for a steel works is being planned. In the Congo, a Swiss engineering office has been asked to act as consultants for the planning of the big hydro-electric development project at Inga, on the lower course of the river Congo.

In the steppes of Syria, a series of dams has been built on the river Oronte to protect the country against floods and to use the waters for irrigation and pisciculture. In Iraq, a network of transmission lines nearly 470 miles long, with about fifteen substations, capable of supplying the whole southern part of the country with electricity is planned by a consortium of Swiss engineering offices.

In India, the project for the Konar dam, which is part of the scheme for harnessing the resources of the valley of Damodar, and more recently the Koyna scheme, have both been awarded to Swiss firms. In Japan, the same is true of the Hitotsue dam project.

In Greece, a big irrigation project is being carried out in the Peloponnese comprising the building of a 280 million cu. ft. earth dam on the Pinios. In the Iberian peninsula, dams have been built in Portugal on the Rio Pracana and the Tagus and in Spain on the Alberche, the Viar, the Guadaira and the Naute for the production of electricity and irrigation. In Luxembourg, it was also a Swiss engineering office, that was responsible for the general co-ordination of the planning and execution of the Vianden hydro-electric project in the valley of Our.

In addition, in a great many countries Swiss engineers have been called on in the capacity of experts to supervise projects, study particular problems and help governments or private companies arrive at the most economical and most rational solution for the development of a region or the carrying out of a big project.

In all these countries, Swiss engineers, and perhaps this can be explained by the diversity of languages and cultures met with in their own country, have shown great ease of adaptation to very varied economic, technical and cultural conditions. This is indispensable, for in order to ensure the rational and efficient execution of a project, the plans must take account of local factors, such as the method or running the plant to be built, the types of material available, the influence of the climate, the effect of the prices of raw materials and wages, etc. Sometimes the results are very different from similar engineering projects carried out in European countries. The methods of doing business and the types of contract binding the engineer to his client also differ greatly from one country to another.

Very frequently, the Swiss consulting engineer works in close co-operation with a local technical office, thus combining the knowledge of local conditions possessed by the latter with his own specialized experience. At the same time, such co-operation offers technicians of the country in question the possibility of getting to know the latest techniques developed in Europe and to see in what way they can be adapted to local conditions. It should also be pointed out that Switzerland has always maintained her political independence and her neutrality. The governments of a number of countries, in particular those that have recently gained their independence, are happy to call on a Swiss office, for they are sure in this way of receiving the specialized technical assistance they need without any fear of foreign intervention in their internal political affairs.

Swiss engineers, in their turn, are glad and proud to co-operate in the carrying out of big equipment projects for these new nations and to be able to show that the fame that Switzerland has acquired down through the years for her exports of manufactured products also extends to her export of technical know-how.

*(By courtesy "Swiss Industry and Trade".)*

## THE HUNDREDTH ANNIVERSARY OF A SWISS INDUSTRIAL PIONEER

It is a century since the machine builder Walter Boveri was born at Bamberg in February 1865. In 1891, he and Charles E. L. Brown founded the firm of Brown, Boveri & Co at Baden. This firm rapidly played a leading part in the growth of Swiss hydraulic works, in the electrification of Swiss railways and in the Swiss machine industry in general. It has contributed to the excellent international reputation of this branch, as much by its numerous foundations of companies abroad as by its exports.

[O.S.E.C.]