Editors' picks

Treasures from the archives

Clearing the rails

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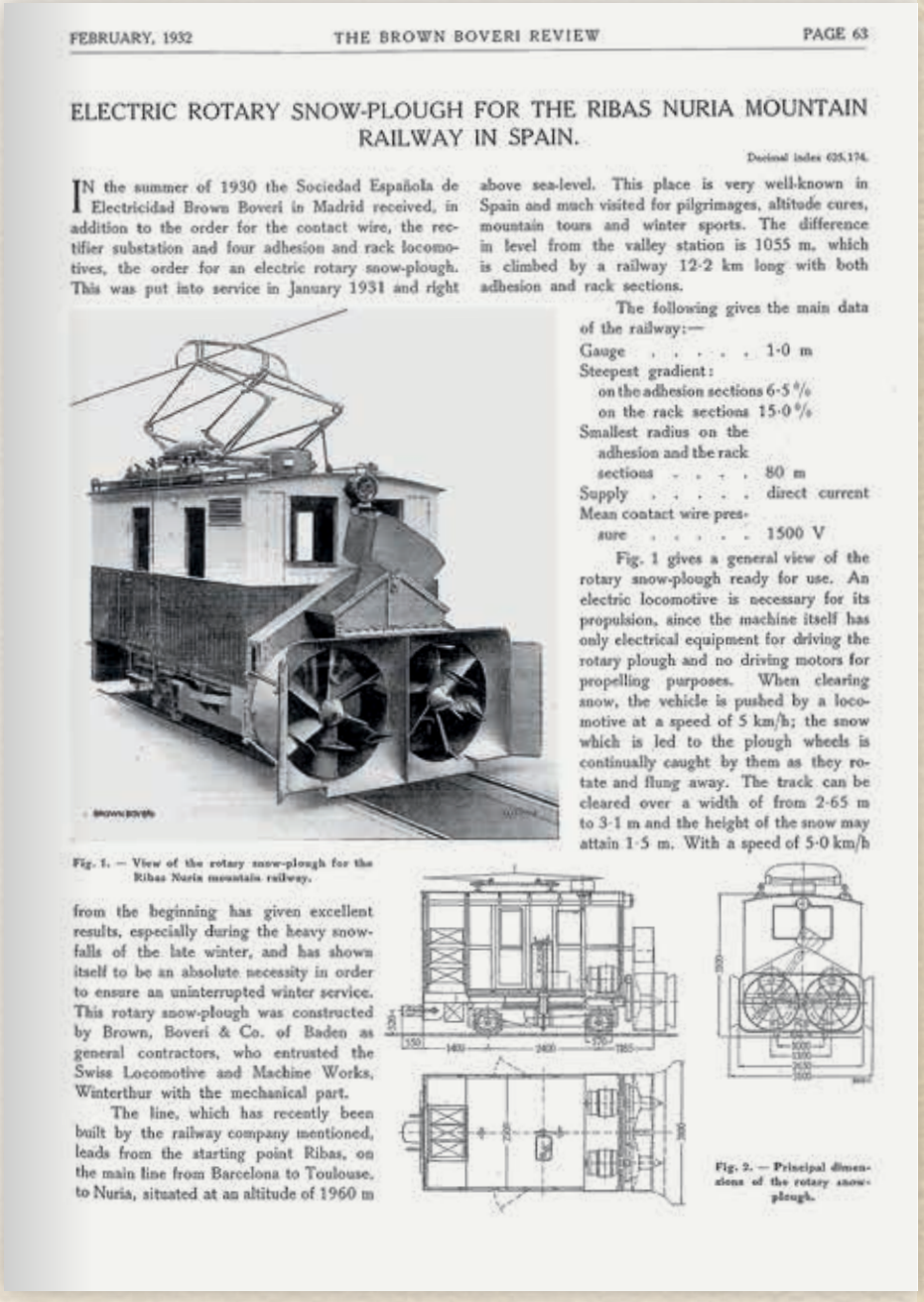
SARAH STOETER – If you're reading this journal, you are probably already well acquainted with ABB's countless power and automation technologies – industrial motors and drives, transformers, switchgear, robots, controllers, ship propulsion units, HVDC, and automation systems, to name but a few. But would you believe that, at one time, ABB made snow plows? This interesting twist in the company's history demonstrates to me the innovative spirit that is very much a part of ABB today. As an editor, it is a privilege to be able to help shape articles about technologies such as this one, to be part of ABB's innovative spirit.

ABB's predecessor companies, ASEA and BBC, both manufactured locomotives and were instrumental in the electrification of numerous railways particularly in Sweden and Switzerland. The electric rotary snow plow for locomotives, described in the 1932 *Brown Boveri Review* article "Electric Rotary Snow-Plough for the Ribas Nuria mountain railway in Spain," nicely complements the rail element of ABB's past.

A 12.2 km long railway, climbing 1,055 m from its valley station in Ribes de Fresser (Ribas) to Vall de Núria in the Pyrenees mountains at an altitude of 1,960 m above sea level, serviced an area "much visited for pilgrimages, altitude cures, mountain tours and winter sports" – a journey, which, in winter, would not be possible without a viable means of clearing heavy snow off the tracks. This was the impetus for the electric-rotary snow plow developed by BBC and SLM, which was put into service in 1931.

E. Hugentobler, (G.A.W.), "Electric rotary snow-plough for the Ribas Nuria mountain railway in Spain," *The Brown Boveri Review*, pp. 63–65, Feb. 1932.



FEBRUARY, 1932 THE BROWN BOVERI REVIEW PAGE 63

ELECTRIC ROTARY SNOW-PLOUGH FOR THE RIBAS NURIA MOUNTAIN RAILWAY IN SPAIN.

Decimal Index 625.174.

IN the summer of 1930 the Sociedad Española de Electricidad Brown Boveri in Madrid received, in addition to the order for the contact wire, the rectifier substation and four adhesion and rack locomotives, the order for an electric rotary snow-plough. This was put into service in January 1931 and right from the beginning has given excellent results, especially during the heavy snowfalls of the late winter, and has shown itself to be an absolute necessity in order to ensure an uninterrupted winter service. This rotary snow-plough was constructed by Brown, Boveri & Co. of Baden as general contractors, who entrusted the Swiss Locomotive and Machine Works, Winterthur with the mechanical part.

The line, which has recently been built by the railway company mentioned, leads from the starting point Ribas, on the main line from Barcelona to Toulouse, to Nuria, situated at an altitude of 1960 m above sea-level. This place is very well-known in Spain and much visited for pilgrimages, altitude cures, mountain tours and winter sports. The difference in level from the valley station is 1055 m, which is climbed by a railway 12·2 km long with both adhesion and rack sections.

The following gives the main data of the railway:—

Gauge	1·0 m
Steepest gradient:	
on the adhesion sections	6·5 %
on the rack sections	15·0 %
Smallest radius on the adhesion and the rack sections	80 m
Supply	direct current
Mean contact wire pressure	1500 V

Fig. 1 gives a general view of the rotary snow-plough ready for use. An electric locomotive is necessary for its propulsion, since the machine itself has only electrical equipment for driving the rotary plough and no driving motors for propelling purposes. When clearing snow, the vehicle is pushed by a locomotive at a speed of 5 km/h; the snow which is led to the plough wheels is continually caught by them as they rotate and flung away. The track can be cleared over a width of from 2·65 m to 3·1 m and the height of the snow may attain 1·5 m. With a speed of 5·0 km/h

Fig. 1. — View of the rotary snow-plough for the Ribas Nuria mountain railway.

Fig. 2. — Principal dimensions of the rotary snow-plough.

Worldwide wonderment

MICHELLE KIENER – They say that if you were to just glace at every piece of art in the Louvre in Paris, that it would take you nine months to see everything. My experience of visiting *ABB Review's* archives was very similar. I've worked for ABB, and read the *Review*, for 15 years yet if I chose to read all of the articles that I wanted to it would have to be my new full time job and it would probably take me beyond retirement age! There was so much fascinating material that it was extremely difficult to stick to the available research time.

Overall, the most striking thing for me was the global nature of both the *Review* and of ABB. It is normal these days to think globally, to cross an ocean in an afternoon, to talk of global reach and globalization, to send a "letter" which arrives on another continent seconds later. And yet the *Review*, as well as its preceding parent companies, ASEA and BBC, were global entities long before such buzzwords and high-speed travel and communications were common place.

In 2014, delivering massive hardware to customers still has its challenges, be they available and suitable transport, inclement weather or low bridges en route – all now coordinated and communicated via e-mail and smartphones. Even sending *ABB Review* around the world has its challenges, be they the array of import regulations or managing the global list of subscribers' which our team of 102 local country distributors have to stay on top of. So I can hardly begin to imagine what achieving the same end result would have been like 100 years ago. Imagine manufacturing, in 1914, a turbine in Switzerland that needs to be delivered to Australia. Imagine sending the commissioning staff there to install it and how long they would have been away from home and with no "local assistance" from Google or a lightweight dictionary in their smartphone. Imagine sending printed copies of the *Review* to different addresses around the world in a time when silent movies were still state-of-the-art technology.

That is why I have chosen to highlight the following article out of the thousands that I could have chosen. For me, it sums up perfectly the pioneering spirit, intrepid nature and "can do" attitude of all the many people that make up ABB, both now and in the past. And the *Review* has been an essential part of sharing their achievements, recording developments and documenting excellence.

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NOTES.

Shipping large transformers.

Decimal index 656. 026:621. 314. 21.

Due to the increasing size of transformers, packing and conveying them to overseas destinations is accompanied by great difficulties to be overcome by both the designer and shipping company.

The most rational way of transporting the transformer is with the core and windings inside the oil-filled tank, while the insulator bushings, oil conservator, underframe and cooling equipment are sent separately. With this method the costs of erection are reduced to a minimum and the drying-out of the transformer on site is rendered unnecessary or else of shorter duration.

The weight of such a transformer when filled with oil, however, often exceeds the capacity of the cranes available on the ship or at the harbours, and the dimensions are greater than those permissible for bridges, subways, railway loading gauges and ships' holds.

In such cases the transformer must be partly or completely dismantled for transport, and the tanks of particularly large units are made in two, or even three parts. The upper part of the tank and also, if advisable, the upper yoke, are then packed separately. Instead of the dismantled top yoke, a temporary device for keeping the core and windings in place is used during transport.

As an example, the shipping of two large transformers to Melbourne (Australia) for Richmond Substation of the Victoria State Electricity Commission might be quoted. These are three-phase, three-winding 50-cycle transformers for outdoor erection, with external water and oil circulatory cooling. The following are some particulars referring to them:

No-load voltage: primary 120,000 V, secondary 22,000 V, tertiary 11,000 V

Rating: primary 31,000 kVA, secondary 37,500 kVA, tertiary 30,000 kVA

Fig. 1. — Transformer being loaded into a ship at Bremen by a floating crane.

Dimensions: Height (over terminals) 6·8 m; Length 4·7 m; Width 2·8 m

	net	gross
Total weight including cooling set but without oil:	66,500 kg	71,000 kg
Heaviest piece to be transported (lower part of tank with core, but without upper yoke and under-frame)	44,000 kg	44,000 kg
Weight of oil:	20,000 kg	

These transformers (see illustration inside front cover of this number) were made with two-piece tank and temporary pressing device for the frame and windings, in order to reduce to a minimum the total weight of the heaviest piece to be shipped (see above), while at the same time simplifying the erection on site as much as possible. Due

Fig. 2. — Transformer on the harbour crane while being unloaded at Melbourne.

Fig. 3. — Motor lorries for hauling the transformer through Melbourne.

Air heater for space research

ANDREAS MOGLESTUE – The archives of *ABB Review* represent a good cross section of the company's activities throughout the last 100 years of its history. While there are domains in which BBC and ABB have been active throughout this period, there are also product areas that have been discontinued or sold, and others again have been introduced through internal innovation or through the acquisition of other companies. Besides these, there are also articles dedicated to rare or one-off products engineered specifically for a particular application.

An article on an air heater for space research discusses an air heater that produces a hypersonic jet of air, able to heat air at 80 to 100 atmospheres to some 1,000 °C and blow it at Mach 12. This heater was produced by Tecnomasio Brown Boveri S.A. in Milan for the Centro Richerche Aerospaziali in Rome.

The 1968 *BBC Review* article discusses the engineering and testing of the heater, but only hints at the application. The Centro Ricerche Aerospaziali was at the time the aerospace research group of the University of Rome La Sapienza, and was working on a satellite launch program called San Marco. Italy launched her first satellite (San Marco 1) in 1964. This was one of the first-ever non-Soviet or US spacecraft. It was nevertheless launched from Wallops Flight Facility in Virginia, United States using a NASA Scout rocket and under NASA supervision. The satellite carried an ion probe to study the atmosphere and equipment to study the effects of long-range radio transmission.

In the following years, the Italians created their own rocket launching platform (also called San Marco) near Ras Ngomeni (Kenya) from which at least 27 rockets were launched between 1964 and 1988.

ABB still has involvement in space research today – for example through its Fourier transform infrared spectroscopy (FTIR), which is carried on satellites to study the atmosphere.

This brief insight into the back story of an otherwise seemingly random item of equiment is illustrative of the way ABB's achievements were often contributory to a broader context.

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AN AIR HEATER FOR SPACE RESEARCH

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An air heater built by Tecnomasio Italiano Brown Boveri S.A. in Milan for experiments in the space research field has been successfully commissioned at the Centro Ricerche Aerospaziali in Rome. With this equipment a high-pressure air flow of 0·5 kg/s can be heated in a few seconds to a final temperature of some 1000 °C. As a result, the jet velocity at the exit nozzle from the duct is twelve times the speed of sound. This article describes the construction and test results.

The Problem

A VERY interesting and original application of an electric air heater has been developed by Tecnomasio Italiano Brown Boveri S.A. of Milan for the Centro Ricerche Aerospaziali in Rome. The heater is used to produce a hypersonic jet of air. The technical problems were considerable, owing to the exacting requirements to be met by the materials of the electrical part and of the sealing system, as these have to operate under extreme conditions.

Air at 80 to 100 atmospheres has to be heated to a temperature of some 1000 °C with the purpose of obtaining a maximum velocity at the exit from the convergent-divergent duct of about Mach 12, which is required for certain types of test.

The difficult question of selecting the correct heat transfer coefficients, which is a determining factor in sizing equipment of this kind, was accompanied by unusual problems of sealing and cooling.

Construction

The principles underlying the design of the air heater shown in Fig. 1 are essentially the same as those usually adopted for normal heaters, inasmuch as the air is brought into direct contact with the heating elements. These are spiral-wound and arranged longitudinally in the flow direction. They are of Kanthal alloy and located in channels in the refractory in a manner which is described more fully below.

The quality and shape of the refractory were the subject of detailed investigation and numerous laboratory tests in order to establish data on thermal expansion and the distribution of electric potential

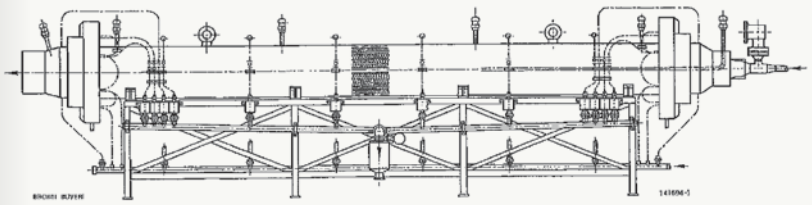

Fig. 1. – Diagram of air heater

Maximum heat output 600 kW, max. pressure 100 atm Maximum air flow rate 0·5 kg/s Maximum temperature 1250 °C