“Quarry Methods in Switzerland”

By George E. Walsh

The Monumental News

Vol. XVII, No. 6, June 1905, p. 419-420

This article begins:

> “It has generally been conceded that American quarry owners have been ahead of any of their foreign competitors in the matter of utilizing modern machinery and tools for simplifying their work; but in some respects the recent installation of the marble and stone quarries of Switzerland bring them fully abreast of any in this country. A good many of the tools and machines employed in these quarries are of American origin, and their adaptation to the work in Europe should in no wise detract from the honor due their American inventors. The equipment of the quarries with electrical power is also due to the cheap supply of current generated by the waterfalls and mountain streams of that little European State….”

Peggy B. Perazzo
Email: pbperazzo@comcast.net
April 2015

Quarry Methods in Switzerland.

It has generally been conceded that American quarry owners have been ahead of any of their foreign competitors in the matter of utilizing modern machinery and tools for simplifying their work; but in some respects the recent installation of the marble and stone quarries of Switzerland bring them fully abreast of any in this country. A good many of the tools and machines employed in these quarries are of American origin, and their adaptation to the work in Europe should in no wise detract from the honor due their American inventors. The equipment of the quarries with electrical power is also due to the cheap supply of current generated by the waterfalls and mountain streams of that little European State. In respect to its size, wealth and population, Switzerland has more horsepower developed from utilizing streams and waterfalls than any other country of Europe, and it has built up a large number of industries in the past few years as a direct result of this.

The working of the marble quarries has been completely revolutionized in the past five years. Prior to that time they were worked in the most primitive manner. The cost of getting the marble from the quarries and transporting it to the markets was so great that, in spite of low wages and plenty of cheap labor, it was difficult to find much profit in the industry. The returns from the quarries were so small that a great many of the smaller ones were abandoned. In the past few years all of these have been brought into activity again, and their output is steadily increasing.

The largest and most famous of Switzerland's marble quarries are those located at St. Triphon, in the valley of the Rhone, not far from Lake Leman. The marble is very handsome, and has been used quite extensively in Europe for upward of two centuries. Some of the finest churches of Europe are decorated with St. Triphon marble, and for mausoleum and monumental purposes it can be found today in hundreds of cemeteries throughout Europe. This in spite of the slow and costly operation of quarrying the marble that was in vogue until very recently. Although the railroad station is located only half a mile away, the difficulty of getting the marble blocks from the quarries and loading them on the cars by the old system was so great that the annual output was extremely small.

Under the present equipment of the quarries electrical machinery performs nearly all the mechanical work that was formerly done by hand. The cutting of the blocks is carried on by means of an endless cable operated by electric motors. This cable runs upon jointed pulleys, and it can be operated to meet any emergencies. The operator controls the movement by a touch of a finger on a series of buttons, which depress or raise the cable, or change its speed or general direction. The cutting cable is composed of three strands of very hard steel wires twisted together to form a uniform cable. Having a maximum movement of about seven feet per second, the cutting cable can work with rapidity, and with such sureness of direction that little trouble is experienced. A stream of fine cutting sand and water is automatically played upon the wire or cable to increase its cutting powers.

Since the installation of this electric endless cable, the output of the cutting department has been doubled, and at less cost in money and men. One man can work the cutting of the marble much better than five men could do it before. It was not many years ago that the cutting of the marble block was performed by hand and with the most primitive of tools. The change to the present form has worked improvements in the quarries that have greatly stimulated interest in the industry.

Probably the most important features of improvement in all marble and stone quarries have been in the changes in lifting and conveying machinery. Fully half the trouble and expense of operating a quarry is exhausted in lifting and carrying the blocks from their beds to the nearest railroad or steamship line. Anything that will simplify this work, and reduce the cost, must naturally redound greatly to the benefit of the owners.

In our own quarries lifting cranes of all sizes and types have been adapted to this work, and conveying machinery has been installed to reduce the work of transporting the output of the quarries. In some respects the St. Triphon quarries, and one or two of the largest in Belgium, are abreast of any American mines so far as handling the heavy blocks of marble are concerned. A combination of electric crane and overhead car has been in operation at St. Triphon for some little time, and it furnishes important data for those interested in handling quarry products cheaply and effectively.

The lifting crane is mounted on a railroad track which is laid on either side of two supporting iron pillars, and which can be extended as work in the quarry progresses. The tracks are about 100 feet apart, and the great crane moves on this track without much friction. The supporting columns of the crane are of iron, spread out at the bottom and tapering toward the top. The crane and the car which moves along the top of the iron structure are built solid enough to carry extremely heavy loads, but they are not clumsy and awkward to handle. The whole ironwork gives rather a weak and spindling appearance at first view, but closer inspection shows that it is very firm and rigid.

The main bridge of the crane is upward of 150 ft. long, and the height above ground is some 35 feet. The rails which are constructed on this bridge to carry the electric car run the total length of the bridge, giving a wide field of operation. The total lifting capacity of the crane is over forty tons. This maximum load, however, is not exerted at the outer ends of the overhanging parts, which extend some twenty feet beyond the pillars, but even at these extreme ends the crane has a safe lifting capacity of approximately thirty tons.

The traveling carriage is operated by electric motors. Four motors operate all the different movements of the huge crane. The movement of the crane upon the track is first controlled by two seven-and-a-half horsepower motors, making a total of 15-horsepower. These motors are located on the supporting columns, and are worked on 110-volt direct-current circuit. They make a speed of 1,300 revolutions per minute, but this high speed is reduced by means of an endless screw working in oil at the rate of about 38 revolutions per minute.

In adjusting these two motors, placed on opposite sides of the bridge of the crane, it was important that they should work together, but even when perfectly balanced it was feared that trouble might develop in an emergency through one working faster than the other. The result of such an accident would mean the faster movement of one pillar than the other, and when carrying a heavy load the strain to the iron bridge might cause a serious fracture. To prevent any such trouble the shafts of the motors were joined by a strong transmission gear running entirely across the bridge.

The carriage of the crane is operated back and forth on the bridge by means of an endless screw and a gearing transmission. The screw works in a dust-proof oil chamber, and it is driven by a five horse-power series-wound motor. The motor has a speed of 1,350 revolutions per minute, but the screw reduces it to twenty-two. The control of the carriage on the bridge track is perfect, and its operation is so simple that the workman in charge can adjust its advance to the fraction of an inch. The operator who singly controls all the different mechanism and movements of the different parts of the crane has a small switchboard house on one of the main columns of the crane.

The fourth motor of the crane controls the lifting of the blocks direct from their beds in the quarries. This motor is mounted on the car and is of fourteen horsepower. It is a compound-wound motor which operates at 900 revolutions per minute, and is reduced by the endless screw to 15 revolutions per minute. The lifting arrangement is equipped with a powerful brake which makes the control of the load perfect. By means of a rheostat controller every part of the crane can be regulated in its speed so that the nicest adjustment imaginable can conveniently be made at any time.

The current for operating the electrical machinery of the quarries comes from the hydraulic transmission plant at Grande Eau. The power plant develops energy from the falls, and transmits it to the quarries and manufacturing plants along its route. A thirty-horsepower 110-volt generator is used for supplying the motors with current at the St. Triphon quarries; but only such energy is paid for as is actually used. This produces a most important saving, for despite the apparently large size and weight of the huge crane its operation when in continuous service is inexpensive. A relatively small current will keep it in operation after it has been once started. Experience has shown that the crane can be run continuously after once started on three to four horsepower, with a current of 22 to 25 amperes at 110 volts. The amount of power required to start the crane is relatively large, but the almost immediate reduction in consumption of power lessens this cost. From fifteen to twenty horsepower are required to start the movement of the crane when loaded.

Recently an electric railway line has been equipped for transporting the blocks of marble to the railroad station. As this line connects directly with switches of the steam road, the electric locomotive can haul the cars to the quarries and when loaded by means of the electric crane they are taken back for shipment on the main line. The construction of this mile of double track has not only increased the output of the St. Triphon marble quarries, but it has increased the profits greatly. The same power which controls the crane and other machinery of the quarries also supplies the electric locomotive. The locomotive is equipped with two fifteen horsepower motors, working at 110-volts, and it can draw three ordinary loaded cars along the tracks. The current is carried to the locomotive by trolley from overhead wires until the quarry is reached when the wires are placed within a few inches of the ground so as not to interfere with operations of cranes and swinging booms.

As quarrying today is rapidly becoming a matter of mechanical equipment of the most modern type, the account of the St. Triphon quarries should indicate something of the best kind of practice observed abroad. In no other European country, except Belgium, have the quarries been so thoroughly equipped with electrical apparatus as that just described, and the short time in which it has been in operation has fully demonstrated the value of electrical machinery when current can be obtained in reasonable volume and at low rates. The elimination of the slow hand-method of handling marble and stone blocks in quarries is one of the most important changes in this industry, and electricity at home and abroad is demonstrating its value in this direction as a motive power.

George E. Walsh.