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IN THIS ISSUE:  
THE BEGINNINGS OF A GREAT  
NEW HAMPSHIRE INDUSTRY

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# THE BEGINNINGS OF A GREAT NEW HAMPSHIRE INDUSTRY

*By George B. Upham.*

The Sullivan Machinery Company now has offices in Boston, New York, Pittsburgh, Knoxville, St. Louis, Cleveland, Duluth, Dallas, Joplin, Denver, Spokane, El Paso, Salt Lake, San Francisco; and agents in other industrial and mining centers in the United States; also in Toronto, Vancouver, Mexico City, Santiago in Chile, and Lima in Peru. In the old world it maintains headquarters at London and Paris and before the war had a flourishing branch in Petrograd. A branch has been maintained for many years in Sydney, Australia, and the company's representatives are selling Sullivan mining machinery in Japan, India, The Federated Malay States and South Africa.

Sullivan machinery for excavating rock in mines, tunnels and quarries, for compressing air, for prospecting for minerals, and for mining coal is found in every part of the world where these industries are carried on. This article tells of the small, yet interesting, beginnings of this New Hampshire industry.

The establishment of the machine business in Claremont, N. H., which later became the Sullivan Machinery Company, was due to the enterprise of James Phineas Upham, who made a beginning there shortly after his graduation from Dartmouth College in 1850. How he came to be born and to live in Claremont may be told in a few words, involving an interesting and little realized fact in American history.

In the later years of the eighteenth century the Upper Connecticut river valley was to the settled communities of Southern New England what the middle west became to all New England half a century later. Enterprising people went there, "to grow up with the country." Mr. Upham's father, George Baxter Upham, after graduation at Harvard in 1789, saddled his horse, rode north from Brookfield, Mass., settled at Claremont and there began the practice of the law, which he continued throughout Western New Hampshire for forty years. He founded the first bank in Claremont, and was elected to Congress for several terms, riding to and from Washington on horseback. He died in 1848. His son, after graduation from Dartmouth, returned to Claremont and bought lands on the slopes of Barbers Mountain and bordering on the Connecticut River which are still

occupied by his descendants. Although without mechanical training Mr. Upham was always intensely interested in machinery, especially in new and useful improvements.

A little machine shop with a small foundry was then in existence on a part of the present site of the Sullivan Machinery Co., in Claremont. Mr. Upham bought it in 1851. It was at first carried on in the name of Mr. Upham's bookkeeper and known as "D. A. Clay & Co." When additions to the buildings and machinery had been made, in 1854, it was dignified by the name "Claremont Machine Works." Among its products then advertised were "Engine lathes of 4 sizes and the latest patterns," "Iron Planers of a new and desirable style," "Paper Mill Machines" and Circular Saw Mills, the best in use. These mills will saw 1,000 feet of boards per hour. We are now filling orders for them for the great pine timber regions in Minnesota." The "Tuttle Water Wheel," was another product, which, however, was soon superseded by the "Tyler Turbine Water Wheel," invented by John Tyler, a resident of Claremont. The latter wheel was extensively manufactured by the Claremont Machine Works and its successors for a third of a century.

In 1856 this wheel was exhibited

at the Crystal Palace in New York and received the highest prize medal awarded to water wheels. More than three thousand were manufactured by the Claremont Machine Works and its successors, some made in sections to be carried up into the Andes and other mountainous districts on muleback.

The Claremont Machine Works at about the same time also received the highest premiums awarded at the Crystal Palace in New York for engine lathes and planers. The Tyler water wheel was to be found in almost every state and territory of the Union. For many years in

At about this early period the business was recorded as having an invested capital of \$15,000 and employing thirty men, probably an understatement of both.

About 1860 Mr. Upham, continuing to be the sole owner, changed the name to J. P. Upham & Co. During the sixties the manufacture of the Tyler Water Wheel was continued in large numbers; thousands of water wheel regulators were built, and lines of agricultural machinery were added, among which were the "Clipper Mowing Machine;" the "Lufkin Side Hill Plough," one of the early, improv-



THE SULLIVAN MACHINE COMPANY IN 1869.

competitive tests at various places these water wheels showed the highest percentage of efficiency for the amount of water used.

As early as 1854 the "Works" were fitted out with "A Large Chucking Lathe having a swing of 6 ft. 9 in. and adapted to the heaviest work," with "Boring and Screw Cutting Machines, and Gear Cutters for all kinds of machinery." All work sent out was warranted. Thus early did the predecessors of the Sullivan Machinery Company establish the principle of standing behind its work.

ed reversible ploughs; the "Colby Cultivator and Harrow," a predecessor of the disc harrow now in common use; and the "Hunt Sulky Plough," believed to have been the first of that type.

On an afternoon in May, 1868, Mr. Upham was pruning apple trees near the highway, leading up the Connecticut River valley and known in colonial days as the "Great Road." (See Granite Monthly for February, 1920.) Two strangers driving in a light "buggy" stopped, inquired where Mr. Upham lived and on learning that Mr. Upham

was speaking to them, hitched their horse to a tree and talked with him for an hour or more; they on the outside, he on the inside of the moss grown stone wall, a broad stone serving as a desk for the exhibition of sketches and for mathematical calculations. The writer, then a boy, looked on with interest. The strangers were Albert Ball and Roger W. Love from Windsor, Vermont, seven miles up the river. They brought with them sketches

come well known throughout the world, it seems worth while to relate the circumstances which brought the three together.

The historic village of Windsor for more than half a century had been the scene of much interesting mechanical development. Professor Roe's able work on "English and American Tool Builders" (Yale University Press) begins with a description of the tool made for boring the cylinder of Watt's first



WORKS OF SULLIVAN MACHINERY COMPANY, 1921.

of a newly invented and patented diamond channeling machine for quarrying stone, especially marble. An agreement to build this machine was made then and there, and this interview over the old stone wall may be truly said to have been the inception of the Sullivan Machinery Company as an organization devoted especially to the construction of rock cutting and mining machinery.

Since the meeting of these three men resulted in the organization of a corporation and the establishment of a business which has since be-

come well known throughout the world, it seems worth while to relate the circumstances which brought the three together. The historic village of Windsor for more than half a century had been the scene of much interesting mechanical development. Professor Roe's able work on "English and American Tool Builders" (Yale University Press) begins with a description of the tool made for boring the cylinder of Watt's first steam engine, 1769, and continues down to 1915. Of its 294 pages about one-eighth are devoted to mechanical developments at Windsor, Vt. Had this book attempted to tell of all the inventions that originated and were developed in that little village every page of it would have been required for the purpose.

In 1863 an enterprising New Englander, Mr. E. G. Lamson, was engaged in the manufacture of machinery in Windsor. Mr. Lamson was a somewhat restless per-

son who travelled much and was possessed of boundless energy. Of a decidedly inquiring turn of mind, he made acquaintances everywhere, under all circumstances. Had he not possessed these characteristics the Sullivan Machinery Company might never have existed. Among other products of Mr. Lamson's establishments were sewing machines and sewing machine needles, for which he required a



ALBERT BALL.

Chief Mechanical Engineer of Sullivan Machinery Co., for nearly 50 years.

small but extremely accurate engine lathe. Albert Ball, born at Boylston, Mass., in 1835, and at the time in question employed by L. W. Pond in Worcester, had built such a lathe for his own personal use.

Mr. Lamson, learning of this fact from a fellow passenger, straightway repaired to Worcester, found Mr. Ball and ordered two such lathes. Mr. Ball had been making

fine screws for a fire-arm then manufactured by his employers. To see almost any piece of mechanism was sufficient to suggest to his mind an improvement. He constructed a combined repeating and single loading gun. Mr. Lamson saw it and then and there bought the patent rights, at the same time engaging Mr. Ball to go to Windsor to further develop his invention and to superintend the manufacture.

In the spring of 1866, while riding in a railway train north from New York to Windsor, Mr. Lamson with unerring eye selected a seat beside a man who, it developed, was on his way to St. Johnsbury, Vt., to make arrangements for the manufacture of an improved stone channeling machine. Mr. Lamson soon convinced his new acquaintance that there was no need to travel so far north, and that the place for which he was really destined was Windsor. The negotiations with him fell through, but Mr. Lamson, his mind started in that direction, was determined to build a stone channeler. He directed Mr. Ball to make the working drawings upon the principle used in a certain trip-hammer. After investigation the latter reported that if so built it would infringe upon the patents of the friend of the railway car, whereupon Mr. Lamson said, somewhat sharply, "You attend to the working drawings, I'll attend to patents."

On another railway journey a few months later Mr. Lamson seated himself beside a clergyman, a Mr. Love, who had recently inherited \$40,000. Mr. Lamson soon discovered that fact with the consequence that this money was invested in his stone channeler. The United States Circuit Court was unkind to Mr. Lamson in this adventure. The clergyman's investment proved a permanent one.

Fearing that not all was as he had hoped, the Rev. Mr. Love sent his son, Roger, graduate of Brown University, a recently discharged soldier who had been present fighting throughout the siege of Charleston, to Windsor to investigate. Mr. Lamson generously offered the young man a position as accountant in his office.

Roger Love saw the stone chaneler, then under the cloud of an



JAMES PHINEAS UPHAM,  
Predecessor and Founder of the  
Sullivan Machinery Company.

injunction for patent interference, and conceived the idea of channeling stone by boring intersecting holes with diamond drills operated in gangs. Mr. Love was not a mechanic, so Mr. Ball, outside of working hours, draughted a machine developing the idea. Mr. Lamson heard of this and sharply reprimanded him. The resignation of both and the interview with Mr. Upham over the stone wall prompt-

ly followed. Thus were these three men brought together, and thus came into existence the Sullivan Machine Company.

It is of interest to note the consequences of Mr. Ball's improvement in rifles. The U. S. Government contracted for two thousand of them, but about the time they were completed the Civil War ended. The Windsor Company then had five hundred rifles on hand. A wide awake German saw one of them in New York, bought the entire lot and shipped them to Prussia. The government of that belligerent autocracy immediately reproduced them, with some modifications, in enormous numbers. With this superior arm Prussia was then prepared to go out and steal something from her neighbors. She promptly did so. Defeating Austria and her allies, who had no repeating rifles, at the battle of Sadowa in July, 1866, she practically annexed not only Schleswig, Holstein and Hanover in the north, but also some half dozen South German states which had been the allies of Austria. Thus was the inventive genius of the man who was to be for nearly half a century chief mechanical engineer of the Sullivan Machinery Company unwittingly a cause of Prussia's military ascendancy. The Ball repeating rifle is an acknowledged progenitor of the Winchester and other leading repeating rifles. Mr. Ball was also, in 1863, the inventor of the cartridge greasing machine which, with little change, is everywhere in general use today.

Work was begun upon the diamond channeling machine as soon as the working drawings could be prepared. It was completed August, 1868, operated upon blocks of marble on an outdoor platform where the shipping room of the factory is now, and first tried in the quarries of the Sutherland Falls

Marble Co. (now Proctor, Vt.) in September, 1868.

On January 18, 1869, the Sullivan Machine Company was organized under New Hampshire laws. The name Sullivan was that of the county in which the business was carried on, which had been named for the intrepid General John Sullivan, who with General Stark had shared the principal honors of New Hampshire in the Revolution.

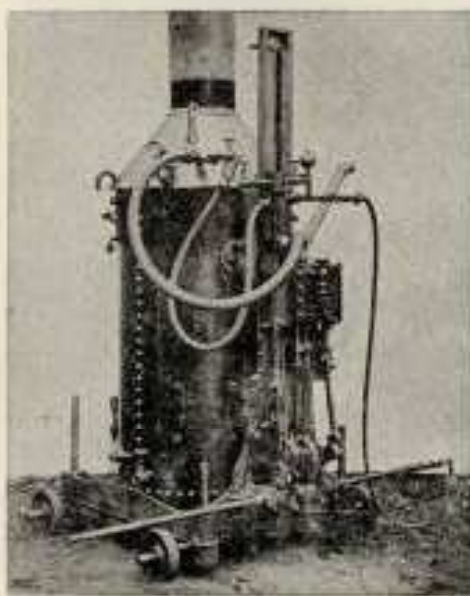
The incorporators were James P. Upham of Claremont, Roger W. Love and Albert Ball of Windsor, Horace T. Love and Edwin T. Rice of New York City. The purposes were "carrying on a General Foundry and Machine business, including the development of inventions and the holding and management of Patents relating to Machinery." The capital stock was fixed at \$200,000.

At the first meeting held on February 6, 1869, the five incorporators were elected directors. James P. Upham was elected president, an office held by him for twenty-three years; Roger W. Love, Treasurer, and Albert Ball, Superintendent and Mechanical Engineer. Mr. Love and Mr. Ball came to reside in Claremont in the spring of 1869.

In February, 1872, John Henry Elliot of Keene, N. H., who for years had been a personal friend of Mr. Upham, invested \$50,000 in the business, taking unissued stock at par to that amount; he was immediately elected a director in place of Horace T. Love, and remained a director until his death in 1895.

A few words respecting the characteristics of the early officers of this company. Mr. Upham was public spirited, enterprising, genial and ever ready to aid in all improvements. Mr. Elliott had backed with rare judgment numerous successful enterprises in New

Hampshire; a sparkling wit and an effervescent humor made association with him a continued delight. Mr. Ball's chief characteristics were and are an extreme modesty and a quick perception of how to accomplish any desired operation by mechanical means. Mr. Love in personal appearance and cerebral activity was keen as a razor. Mr. Rice, a learned and highly cultured lawyer, was counsel for the company.



Sullivan Diamond Gadder with boiler, 1870 or 1871.

The first diamond channeler, completed in August, 1868, was a six spindle, variable speed core drill, movable on a track with a gauging device to space the holes, and operative at any angle. It was soon found that the cores caused difficulty by breaking and jamming in the rods, and an obtuse angle, conical, solid head was substituted for an annular head, with at first four, later two, holes for the escape of the water to clear the detritus. Black diamonds were then cheap, costing only \$3.50 per carat. They now cost \$100 per carat.

The diamonds, known in the trade as "carbon," are black, brown, or dark gray in color, with a dull lustre. They have no such cleavage as the white diamonds, so do not split or crumble on rotation of the drill. They are found in gravel and almost exclusively within an area of a few hundred square miles in the province of Bahia, Brazil. The largest one ever found there, in 1895, weighed 3,150 carats. The large ones are, however, relatively less valuable than the smaller sized, since much labor is required and some loss sustained in reducing them to fragments of suitable size for drill heads. Black diamonds are not beautiful, looking much like small bits of coal; but, next to radium, they are by weight perhaps the most costly commercial commodity this planet affords. Aside from use in rock boring they are used only in cutting and polishing brilliants.

About twelve diamonds were set in each head. They averaged about three-sixteenths of an inch in diameter, about nine-tenths of each diamond being embedded in the steel. At the periphery they at first projected slightly beyond the circumference of the head. This channeler made wall cuts at any desired angle, which no other machine was capable of doing.

The first channeler was never sold, but used on contract work in Vermont marble quarries and for a time on red sandstone at Portland, Conn. The channeling price was at first \$1.25 per square foot, later reduced to seventy-five cents. The second was sold to the Columbian Marble Co. and used in its quarries near Sutherland Falls, Vt. The third was sold to the owners of the old Prime Quarry at Brandon, Vt.

In 1871 the six spindle machine was superseded by the two or three spindle channeler, which remained

in use for many years until the high price of "carbon," black diamonds, proved prohibitive. The thousands of square feet of semi-circular drill holes on the walls of stone and marble quarries in Vermont and other states attest the extensive use of the diamond channeling machines made by the Sullivan Machine Company.

The drills sank into the marble at the astonishing rate of eight to ten inches per minute when run at the usual speed of 800 to 1,000 revolutions. A depth of one inch to a hundred revolutions could be depended upon in average marble. The wear on the diamonds, even after long periods of service, was almost imperceptible unless flint or quartz had been encountered, or nuts, or bolts dropped into incomplete channels, when, although nine-tenths imbedded in the hardened steel, the diamonds were sometimes ripped bodily from their setting without being otherwise injured.

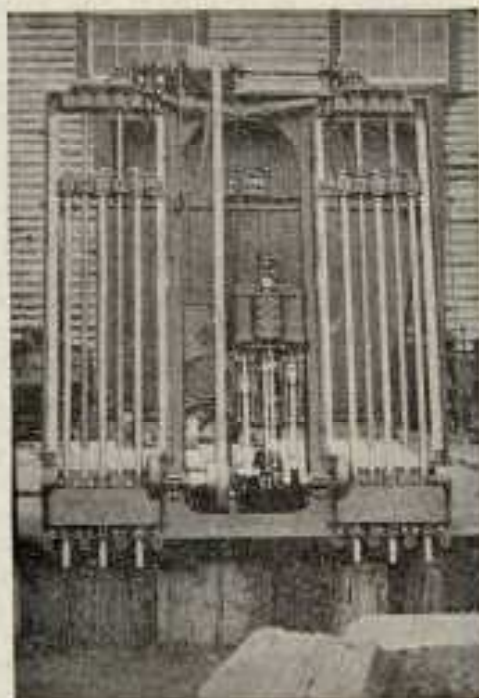
These channelers were so far in advance of all other machines that they became indispensable and elicited the highest praise from many of the best known quarrymen who wrote as follows: "The great labor saving machine of the age;" "Without it we cannot successfully compete with our rivals in the trade;" "Does work hitherto regarded as impossible to be done by machinery."

In 1869 the company built its first "Gadder," a single spindle, solid head diamond drill, used for drilling shallow holes beneath the marble block to split it from its bed. One machine accomplished more and better work than the hand labor of twenty men. In January, 1872, Redfield Proctor, afterwards Governor, Secretary of War and U. S. Senator from Vermont, wrote: "We have owned and worked two of your Gadding Machines for several



years and find them admirably adapted for the work required, and not often out of repair, though in almost constant use."

On January 1, 1872 the superintendent of the Rutland Marble Co. wrote; "We have used your 'Gadder' for two years. It has no rival and is the only practical mechanical appliance for its especial work within my knowledge. It is invaluable because the work done by it is so much cheaper and better than by hand labor."



Sullivan Diamond Channeler at Work, and Wall Cut By It.

It should be stated that prior to the invention of the diamond channeler all channels cut in stone by machinery had been made wholly by concussion, by the successive blows of heavy steel cutters; and that with the then crude mechanism for operating such cutters break downs, caused by the continuous jar, were of frequent occurrence. The blows also strained and sometimes cracked the marble.

The credit for the first application of the diamond to a rock cutting tool belongs to M. Hermann, a Frenchman, whose drawings, accompanying a patent issued in France in 1842, showed various forms of boring tools whose cutting edges were diamonds. It does not however, appear that the idea had ever been put to a practical use in the country where it originated. In 1863 another Frenchman, Rudolph Leschot, took out an American patent for one form of diamond cutter shown in the drawings of Hermann, which consisted of arming the lower edge of a metallic ring with diamonds slightly projecting beyond the periphery.

Leschot's patent was bought by an American company which is not known to have engaged in much, if any, business other than in prosecuting a suit against the Sullivan Company. This litigation was long, tedious and expensive, involving the taking of much testimony in France and Mr. Upham's presence there for many months. The validity of the Leschot patent was finally established so far as it covered the circumferential projection of the diamonds.

Long before the decision was rendered it had been discovered by the Sullivan Company that such projection was not only unnecessary, but a positive disadvantage. With the diamonds set flush the inevitable slight eccentricity in the revolution of the head gave all necessary clearance, the drills running steadier and with less wear.

This article will some time be continued giving an account of some of the deep diamond drill borings made by the Sullivan Company in South Africa and other places, where it has brought up "cores," i.e., stone rods, showing the character of the metaliferous rock all the way down for considerably more than a mile in depth. The

Sullivan Machinery Company is still the largest manufacturer of diamond drills and the largest con-

tractor for diamond drilling in the world.

## I WANT TO SING

*By Grace Stuart Orcutt.*

- I want to sing  
Of earth's unbosoming,  
Of springing rills and modest woodland flowers;  
Of greening moss and thudding summer showers;  
Of arbutus and curling fiddle heads;  
Of dead leaves massed and broken into shreds.
- I want to sing  
Of creatures on the wing;  
Of pudgy moths that beat the glass at night;  
Of fireflies that make the swamp alight;  
Of dusky shadows darting here and there,  
The flitter-mouse that scarcely moves the air.
- I want to sing  
The joy the thrushes bring;  
Up toward the mountain's wood encircled top  
Sonatas on the world below they drop;  
From peak to peak each to the other cries,  
They trill their oratorios through the skies.
- I want to sing  
Of clouds and coloring;  
Where far flung sunset's pinkest afterglow  
Shines in the water at the wharf below,  
Or lingers soft upon an Alpine peak,  
Like patchwork clings behind Sardinia bleak.
- I want to sing  
And make the song to ring  
In every land, in every heart benign;  
I want to touch one chord that is divine;  
I want to make one soul reach out and say:  
" 'Tis good, 'tis good, that you have sung today."