MINING AND SCIENTIFIC PRESS

W. B. EWER.....SENIOR EDITOR

DEWEY & CO., Publishers.

A. T. DEWEY, GEO. H. STRONG.
W. B. EWER, JNO. L. SOONE.

Office, No. 338 Montgomery St., S. E. Corner of California St., diagonally across from Wells, Fargo & Co.'s.

SUBSCRIPTIONS payable in advance—For one year, $4; six months, $2.50; three months, $1.25. Clubs of ten names or more, $3 each per annum. $5, in advance, will pay for 1½ year. Remittances by registered letters or P. O. orders at our risk.

ADVERTISING RATES.—1 *week.* 1 *month.* 3 *months.* 1 *year*
Per line..... .25 .80 $2.00 $5.00
One-half inch.....$1.00 $3.00 $7.50 24.00
One inch..... 2.00 5.00 14.00 40.00

Large advertisements at favorable rates. Special or reading notices, legal advertisements, notices appearing in extraordinary type or in particular parts of the paper, inserted at special rates.

San Francisco:

Saturday Morning, Dec. 13, 1873.

Legal Tender Rates.—S. F., Thurs., Dec. 11—buying, 91; selling, 91¾.

TABLE OF CONTENTS.

UTAH MINE SWINDLES.—We have been thinking for some time of keeping the heading to this item in type constantly, as we have, unfortunately, to use it so often. The Utah people are certainly out of luck in having so many mining sharpers among them, as it does the interests of the country incalculable damage. In future the man who tries to float a Utah mine will have his hands full. We notice that capitalists at the east are making a general onslaught upon those who have robbed them with Utah mining property. John N. Whitney, a prominent mining operator, has been arrested and taken east on a requisition by the governor of Michigan, charged with fraud in the sale of the Eureka mine, Tintic. Three more requisitions are at hand for other parties. The trouble about all this is, that the swindlers never get punished.

COURSE OF LECTURES.—The trustees of the Mechanic's Institute, in conjunction with the State University, have provided for a course of fourteen lectures, to be given by the Professors in the University, during the winter, as heretofore, on Saturday evenings. The price of tickets for the course has been fixed at $2, which is expected to cover expenses. The course will commence Saturday, January 3d, and he as follows: January 3d, President Gilman, on *Modes of Promoting Scientific and Industrial Education in Large Towns.* January 10th, President Gilman, *On the Use and Conduct of Modern Universities in Free and Prosperous States.* Lectures will also be delivered by Professors James Le Conte, Carr, Soule, John Le Conte, Kellogg and Swinton.

Hydraulic Engineering on the Pacific Slope.

Virginia and Gold Hill Water Works—Iron Pipe under a Vertical Pressure of 1,720 feet—A Great Undertaking Working Successfully.

Ever since the silver mines were first opened on the Comstock lode, it has been a question of importance how to supply the towns that spring up in the vicinity, and more especially the mills and hoisting works, with water. A company was organized at an early day, which proposed to use the water from several old tunnels above the level of Virginia City, for the purpose of supplying this want. After a few years they found that the supply would not be sufficient, but by drifting additional tunnels at different locations, they increased the volume of water, which has been plenty up to within the past two years. As the shafts on the Comstock lode were sunk deeper and lower levels run, the supply from the tunnels, etc., diminished sensibly. The water necessary for the growing towns of Virginia and Gold Hill, as well as the new and enlarged hoisting works, required that additional steps should be taken to supply this deficiency. A company which is composed of such enterprising men as Flood and O'Brien, John Skae, Mr. Hobart, Alvinza Hayward, James Fair and John Mackay, directed their attention to the eastern slope of the main Sierra Nevada mountains and especially to the so-called Dall's creek, which is within a distance of 21 miles on the line of the water course to Virginia. They also purchased the necessary lands and a lake called Marlette lake, situated at an elevation of about 1,500 feet above C street, Virginia, and within a mile of the eastern shore of Lake Tahoe, but about 1,000 feet above its level. This lake has an area of about 300 acres and is 15 feet deep when full in the winter.

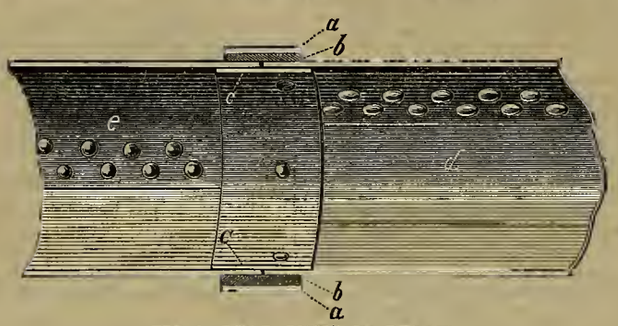

FIG. 1. LEAD JOINT IN DETAIL.

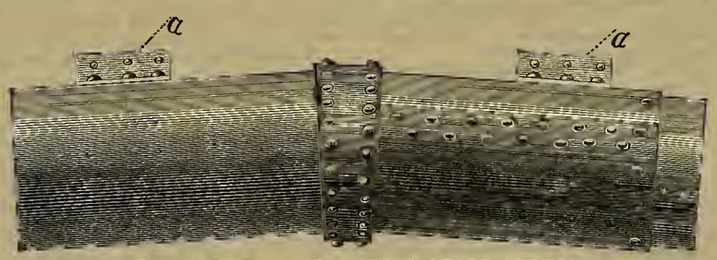

FIG. 2. ELBOW FOR MAKING SHORT CURVES.

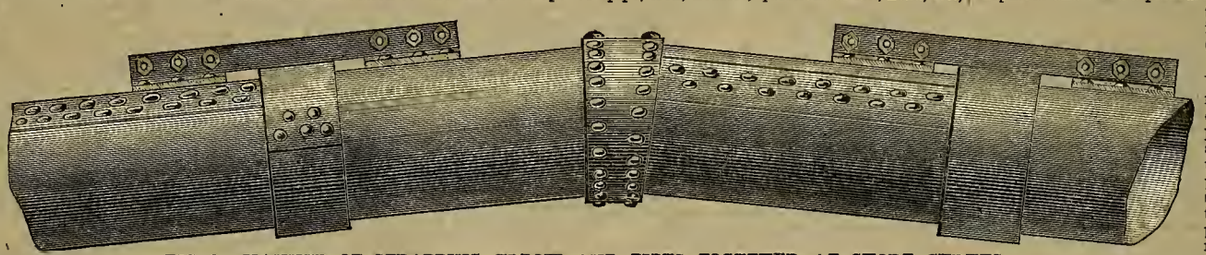

FIG. 3. MANNER OF STRAPPING ELBOW AND PIPES TOGETHER AT SHORT CURVES.

Ths Great Difficulty

In bringing the water from these places over the proposed route, was the necessity of crossing a valley seven miles in width, with steep and precipitous sides, where the pipe in the shape of an inverted siphon would have to sustain a pressure of over 1,700 feet perpendicular.

Ths Work Inaugurated.

In the fall of 1871, the company referred to engaged Mr. Hermann Schussler, of the Spring Valley and other water works, to examine into the feasibility of their project. He reported favorably, and gave the company the assurance of the entire practicability of the scheme. In the spring of 1872 operations were begun, and Mr. Schussler made the necessary surveys personally, and furnished the proper requisitions for rivets and iron, which, by the way, consisted of ten different numbers of the Birmingham gauge, graduated from No. 16 to No. 0. The project was then well under way. The firm of McCrindle & Co., of this city, furnished the Scotch iron, and Geo. C. Johnson & Co., of this city, the rivets, which were of American manufacture. The contract was awarded to the Risdon Iron and Locomotive Works, for making the pipe according to the specifications and under the personal supervision of Mr. Schussler. The Risdon Works, especially owing to the great care of their superintendent, Mr. Joseph Moore, acquitted themselves of their difficult task to their great credit. The Risdon Works make a specialty of this class of work and in many of the various hydraulic enterprises with which they have been connected have made the necessary calculations, and always guarantee their work to do what they promise. They have made a large proportion of the iron pipe now in use in the hydraulic mines in this State, more especially where high heads are used. They have special tools for turning out this work, and Mr. Moore's great experience in this line has enabled him to make accurate calculations as to size of pipe, iron, nozzles, questions of fall, head, etc., so that the Risdon Works make nearly all the pipe used in our mines, always having orders of this kind on hand.

Although during the first month that the water was turned in and through the pipe, a great deal of difficulty was experienced with the

Lead Joints in the Pipes,

On account of expansion and contraction, yet by the application of proper apparatus, shown in the accompanying illustrations, the pipe was made perfectly tight and safe, so that at the present day, after three months' use, the pipe has proved wonderfully successful. It is worthy of remark, as showing the kind of pipe turned out by the Risdon Works, that there was absolutely no leakage in the pipe joints, it only occurring at the lead joints where the pipes are joined together.

Figure 1 shows one of these lead joints, which is made between every two lengths of pipe of 26 feet 2 inches in length each; *a*, is a wrought iron collar, always one-sixteenth of an inch thicker than the thickness of iron in the respective pipe, leaving a play of ⅛ of an inch between the inside of the collar and the outside of the pipe. The collar is five inches wide; *b*, is the lead which is run in and then caulked up tight from both sides, the thickness being ¾ of an inch; *c*, is a nipple of No. 9 iron, 6 inches in width, riveted in one end of each pipe by means of six ⅝ rivets.

Figure 6 shows the method of

Tightening Leaky Joints;

a, shows the clasp and its application for forcing back the lead, where it had worked out on account of the longitudinal working of the pipes by expansion and contraction. This is shown both in perspective and in cross section. The clamp, *b*, in Fig. 6, is used to keep the lead in place after it has been forced back by the clamp, *a*. The two lower sketches of this clamp, *b*, show both a side view and elevation.

The Pipe,

The most difficult feature of the undertaking, begins at an elevation of 1885 feet above the track of the Virginia and Truckee railroad, at a point about two miles west of Lake View Toll House, and thence follows by an easterly course the crest of the spur from which it starts; crosses the valley at the toll house referred to, and gradually ascends to its outlet end, making the entire length 37,100 feet. The water at present is taken from Dall's creek by an 18 inch flume four miles long, to the inlet, or western end of the pipe. From the outlet or eastern end of the pipe, the water is conveyed through a flume of the same size, 9 miles long, into Virginia and Gold Hill, where it connects with the present city pipe system. In the future the water from Marlette lake will be conveyed to the inlet of the pipe and be added to the supply from Dall's creek.

All the iron pipe used is coated, inside and out, with a mixture of asphaltum and coal tar, thoroughly boiled together, each separate piece being plunged and rolled about in a bath of this mixture for from seven to ten minutes before being shipped to its destination. The average diameter of the pipe is 11⅛ inches, and its entire weight about 700 tons. Nearly one million rivets were used to manufacture it and some 35 tons of lead were required in making the joints. At the point of heaviest pressure the iron is No. 0 thick, and is hot riveted with ⅝ inch rivets, there being a double row on the straight seam and a single row on the round seam. The pressure gradually decreases as the ground rises to the east and west, and the iron decreases in thickness from five-sixteenths to one-sixteenth of an inch toward both inlet and outlet. But on its course to the outlet, it having to cross a great many spurs and sags, the iron varies of course according to the pressure, as the diagram (Fig. 7) shows.

Pressure on the Pipe.

The inlet has a perpendicular elevation above the outlet of 465 feet, but just now only 300 feet is used, as this head will supply ten times as much as the two towns have heretofore had. This head carries into Virginia about 2,000,000 gallons every 24 hours, and by increasing the head to its fullest capacity, the supply can be increased to 2,350,000 gallons per day. When the water is running with its present supply, as used at Virginia city, it has a pressure of 1,720 *feet perpendicular* or 750 *pounds to the square inch.* But while the extra tests were being applied the pressure was brought as high as 800 pounds to the square inch without injuring the pipe in the least. The pipe and a joint were tested at the Risdon Works before shipment and stood a pressure of 1,400 pounds to the square inch.

Crossing the Gorges and Spurs

Was a difficult matter to carry out with the pipes. Fig. 2 shows the elbow used for the purpose of making short curves in the line of the pipe around rocky bluffs, through sharp cañons, etc; *a, a,* are angle irons riveted on the pipe on the outside of the curves, which, by means of iron straps, were connected with the corresponding angle iron on the next pipe.

Fig. 3 shows the manner in which the pipes and elbows were strapped together, wherever the curve was sufficiently short to require this precaution against an outward movement. The iron strap is put on the outside of the curve to strengthen the pipe.

Fig. 4 shows the blow-off used in every low place, and marked with a triangle in Fig. 7.

Fig. 5 shows the self-acting

Air, or Vacuum Valve

used at each high point on the line of pipe. When the water is on, the valve, *a*, is kept wide open; the small valve, *c*, is shut, while the valve, *b*, is shut by the pressure. If any air accumulates in the pipe, on the elevation where this air cock is placed, it is occasionally blown off, by opening the cock, *c*. Should a break occur in the main pipe line at a point lower than the air cock, and within its district, the valve, *b*, falls down and admits the air into the main pipe so as to prevent a vacuum. Should the valve, *b*, get out of order, the valve, *a*, is shut, and the other valve, *b*, taken off and repaired. After a break on the main line is repaired, and the water let on again, the valve, *b*, being

down or open, the air rushes out at *b*, its stem being weighted by the weight, *d*, so as only to close when the solid water commences to rush out.

Engineering Difficulties.

Fig. 7 will give our readers an idea of the country over which this undertaking was carried out, as it shows a profile of the pipe. The triangles below the lines indicate the location of the blow-offs. *O*, above the line, represents the cocks. The numbers shown along the undulating line show the numbers of iron used under the various pressures. The perpendicular columns of figures from 100 to 1,700 indicate the pressure on the pipe at the points where the parallel lines strike the profile.

Quick Work.

From the time of commencing the manufacture of the pipe until the water ran into Virginia City, only five months elapsed, the water arriving there about the first of August. To construct a work of such magnitude in so short a space of time, and with such success, reflects great credit on the engineer, the foundry and all concerned. The diagrams used in connection with this article were kindly furnished us by Mr. Schussler, and we produce them here to give the mechanical world an idea of the details of construction of the line. As an undertaking in hydraulic engineering it was difficult, as the body of water had to be passed through a huge inverted siphon over seven miles long, in doing which such an enormous pressure as 1,720 feet had to be overcome.

Greatest Pressure in the World.

Up to the completion of these water-works, the Cherokee Flat pipe, which is under 930 feet pressure, was sustaining the greatest pressure of any in the world. Mr. Schussler was also consulting engineer in that enterprise, and figured the exact thickness of iron and quantity required at different pressures, number of rivets, etc. The pipe which we have been describing sustains nearly double the pressure of the Cherokee Flat, and stands now the greatest in the world, the ordinary pressure being 1,720 feet. It was an engineering feat of no small magnitude to carry this enterprise to a successful completion; and in view of the difficulties to be overcome, it will attract the attention of engineers all over the world.

Mr. Hermann Schussler,

The constructing engineer of this work, though quite a young man, has been engaged in nearly all the prominent hydraulic engineering enterprises carried out on this coast for some years. He is a graduate of the Prussian Military Academy of Oldenburg, of which he was a member from 1859 to 1862, being promoted lieutenant on the first of January, 1862. In the fall of that year he took leave of absence for two years, and during that time attended the civil engineering schools of Znrich and Carlsruhe, for the purpose of perfecting himself in his intended profession of civil engineer, as he desired giving up a military life. In the fall of 1864, having had his leave of absence changed into a definite leave from military service, he came directly to San Francisco, where he entered into the service of the Spring Valley water works, first as assistant engineer, but was promoted afterwards to chief engineer of the undertaking, which was finally completed to the satisfaction of every one in 1871. From this time his career in other large works on the Pacific coast commenced. He was connected, as consulting engineer, with the Oakland water works, San José water works, Vallejo water works and Stockton water works; was chief engineer of the Marin county water works and those of Virginia City and Gold Hill. During the past year he was chief engineer of the Sutro tunnel company, where, as our readers will remember, he made the very close connection between the header and shaft No. 1, on the 27th of September last.

Outside of all these duties, Mr. Schussler has been employed partly as consulting engineer and partly as projector in various hydraulic enterprises in different parts of the State, which have always been carried out successfully. He surveyed the ditch of the La Grange Hydraulic Mining Company, in Stanislaus county, and was consulting engineer, as before mentioned, of the Cherokee Flat mining pipe. He projected the present Pioche water works, in Nevada, where he makes a five inch pipe of No. 16 iron, 6 miles in length, sustain a vertical pressure of 600 feet. The private water works of General Miller, in Napa valley, were built under his supervision, as were the fire protection works at the New Almaden mine. We might mention numerous other undertakings with which he has been connected, if space permitted, but here instanced enough to give our readers an idea of his ability in hydraulic engineering.

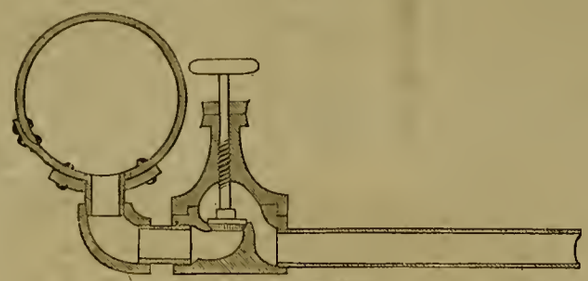

FIG. 4. BLOW-OFF IN EVERY LOW PLACE.

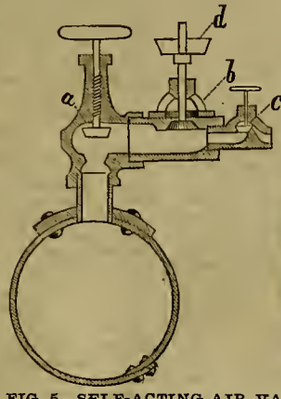

FIG. 5. SELF-ACTING AIR VALVE.

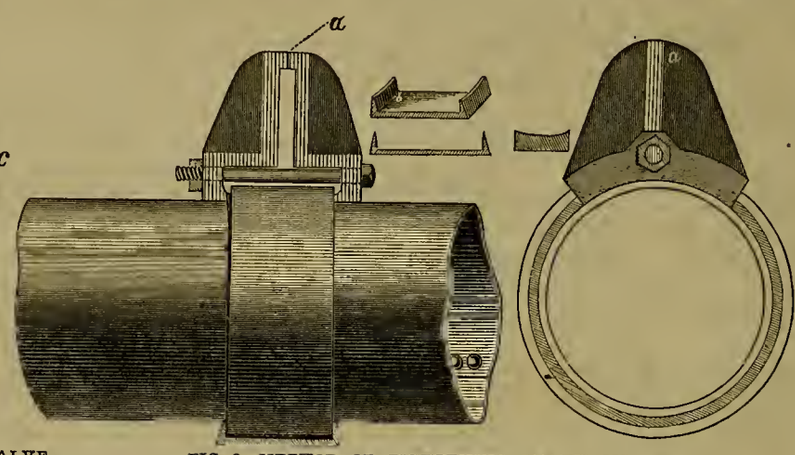

FIG. 6. METHOD OF TIGHTENING LEAKY JOINTS.

Ball's Sweeping Dredger.

Operations were commenced this week to deepen the water on the Oakland bar, across the mouth of Alameda creek. The dredge being used is of a new and peculiar description, the invention of John A. Ball, of Oakland. The buckets run on an endless chain, but operate very differently from those on the ordinary endless chain dredge. The buckets are made to pass down on top of the chain and up underneath, contrary to the usual method. They are made of wrought iron, the nose only being of steel. They cut forty inches across and each one will carry a cubic yard of mud. Each bucket with attachments will weigh about 750 pounds, and the machine carries twelve in all, though only four are rigged at present.

The buckets are made rectangular in form, and rids on two chains on either sids, which are held in pace by and pass over a set of pulleys at both the top and bottom of the ladder. At each sied of the buckets and below their middle, is a journal or trunnion, which is secured to one of the links of each chain, and upon which the buckets swing in their movement around the pulleys. A rod connects the two chains just above each bucket and a link has one end pivoted to each side of each bucket by a rod which passes across inside of the bucket; the opposite end of the link being connected with a curved advance rod. By this means the upper portion of the bucket, as it reaches the top and in turning the pulley, is made to swing out from the curve of the chain and rise in a perpendicular position. While in this position it discharges its load automatically, the curved rod acting as an arm to hold the bucket in its perpendicular position.

The bottom of the bucket is hinged to the side farthest from the chain and a roller or small cylinder is supported at each end by the two chains just below the free end of the bottom when it is closed. It will be readily understood that when the bottom is closed and the bucket stands in a line with the length of the chains the roller will support and keep the bottom closed, but when the bucket moves around the upper drum the lower end will be forced outward and upward by the short turn which the bucket must make, and thus free the bottom from the roller so that it will fall open and allow the load to drop out. As soon as the bucket turns the upper drum and starts down the chain again, the bottom closes automatically and the roller again moves up against it and keeps it closed. The device for operating the valve and holding the bucket in proper position until it is discharged is very simple and effective.

The chain which carries the buckets is a peculiar one, being an improvement perfected by Seth Wetherbee, of this city, who has the contract for dredging the bar. Each alternate link is cast iron, and the chain weighs a little over 30 pounds to the foot. The chain on each side is 114¼ feet long. Each cast link is three inches wide and the wrought ones are 2⅛ inches wide by one inch. The cast link is made with a steel bushing, and a steel pin turns in this bushing, but is otherwise kept in a stationary position. A powerful set screw is arranged to take up any slack in the chains and keep an even tension on both of them.

The barge which carries the machinery is a heavy one, 70 feet long, by 20 in width. The machine was originally made for the Central Pacific Railroad Company, and cost some $14,000. The expense of putting in Mr. Ball's improvement will amount to from $4,000 to $5,000. The engine is of 40 horse power, with a 12 inch cylinder and 28 inch stroke. The engine is connected with the driving shaft of the machine by a system of gearing so as to increase the power.

The "ladder," at the top and bottom of which are the pulleys which carry the chain on which the buckets ride, is 50 feet long, the pulleys increasing it to 56 feet. This allows them to dig 30 feet deep if necessary. This ladder is hoisted and lowered by the engine, so as to vary with the depth of the water. The chain will make a revolution every ten minutes.

Mr. Ball calls his invention the "sweeping dredge," from the peculiar manner in which he proposes to operate it. At the bow or opposite end from the dredging machinery is placed a large triangle made of heavy timbers, which is some 70 feet long. At the pointed end of the triangle is a heavy stake pointed at the bottom and pivoted to the triangle at the top. This whole arrangement is raised by machinery. On beginning operations the triangle is dropped and the pointed "spud" sticks in the mud firmly. An anchor is put out on both sides at the extreme edge of the channel and the dredge is hauled from one side to the other by guys on the dredge. As the spud on the triangle keeps the machine from going ahead or backward, it is "swept" from side to side by the guys to the anchors passing over pulleys attached to the machinery. By this means the machine can take off four feet ahead each time, and can by lengthening or shortening the triangle take in a sweep of 30 feet long and as wide as the length of the triangle will admit. The apparatus requires an engineer, a fireman and a man to "feed" the machine. All the iron work on the buckets, chains, etc., was done at Scoville's machine shop in Oakland, and a very good job he has made of it. At the preliminary trials, made this week, the machine worked well, and active work commences as we go to press. At present the triangle proposed by Mr. Ball is not in use, the barge having a plain "spud" attached in the bow. The contractor has four months to complete the contract.

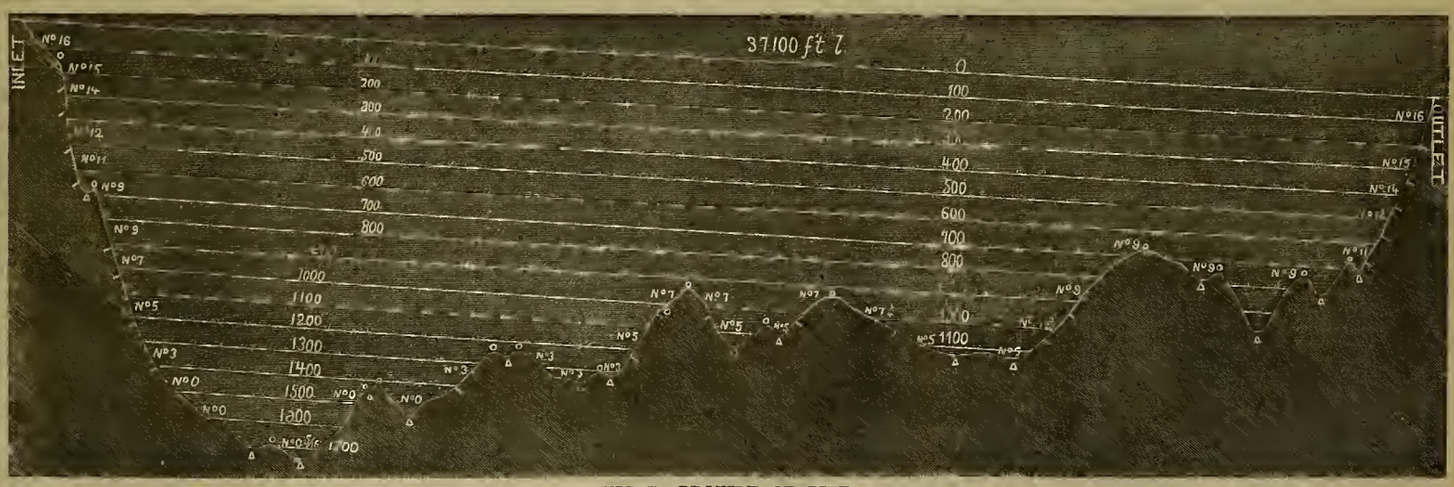

FIG. 7. PROFILE OF PIPE.

MINING ACCIDENTS.—John Mulcahy was instantly killed and his body terribly mangled by falling seven hundred feet down the main shaft of the Hale & Norcross mine, at 8.30 on the 8th inst. Seemingly in a fit of absentmindness he ran a car into the open shaft. The sudden jerk of the car pulled him after it. He fell from the surface to the 700-foot level. His head was taken off from his chin upward; he was cut in two at the hips and both legs cut off near the knees.

Daniel O'Donnel was killed in the Eureka mine, Sutter creek, on the 10th by a rock falling and striking him on the head.