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SATURDAY, DECEMBER 4, 1880.

THE attention of readers of ENGINEERING NEWS is especially requested for the Publisher's Department of this week.

THE last four bodies of the buried workmen were recovered from the Hudson River Tunnel on Monday afternoon. They were found in the north tunnel, to which it is supposed they retreated when they were shut out from the air-lock.

THE land surveyors of the country having made a move in the right direction, we trust they will follow it up at every opportunity. A convocation of surveyors general was recently held in Salt Lake City, the report of which we are to have when published; the annual meeting of the Michigan surveyors takes place in Lansing, on January 11 ensuing, and will, no doubt, be well attended; the Ohio surveyors will meet about that time also. We hope to hear of a continued activity among the brethren of the compass and chain.

IT is with much pleasure we publish the very carefully prepared sketch of the Hanover (N. H.) Water Supply, from the personal examination and pen of Professor Fletcher. In the mountainous regions of several of the Eastern States there must be examples of similar works, an accurate account of which would be of interest to all concerned in the construction of water-works. Professor Fletcher's article is a model which we trust will be extensively followed for the benefit of our readers.

THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

The regular meeting was held on Wednesday evening, at 104 E. Twentieth street Mr. W. E. Worthen in the Chair. The following gentlemen were elected members:

Lyman Bridges, Chief Engineer Nevada Central, Nevada Southern, Nevada Northern, San Francisco & Ocean Shore, and the California Central railways, San Francisco, Cal.

James Foster Crowell, Chief Engineer Elizabeth City & Norfolk Railroad, Elizabeth City, N. C.

Francis Ingram Palmer, Engineer and Manager Erie Basin Dry Dock & Warehouse Company, South Brooklyn, New York.

The thanks of the Society were voted to the parties who so kindly extended courtesies for excursions and entertainment, on the occasion of the Annual Meeting. A paper on the "Renewal of the Foundation of the Pascagoulas Light-House," by J. W. Putnam, Associate A. S. C. E., was read. The paper described the operation of driving creosoted wooden piles through the sand and into solid foundations to a depth of 50 feet, for the Horn Island Light in Pascagoulas Harbor. This was rendered necessary by the constant shifting of the sand of the island on which the light was placed, threatening the destruction of the light-house by undermining down to the bottom of the screw piles, which could not be driven to the depth which has been accomplished with wooden piles in present instance. These wooden piles were 75 feet long, and were forced down first to some distance by the use of the water jet, and afterward driven by the ordinary pile driver. The piles were driven in groups of two, one of which was perpendicular and the other inclined. They were bolted together at top. The removal of the lighthouse from the old foundations to new was accomplished on a trestle of some twenty feet high, without disturbing the continuity of the light, which is a revolving one, and which seems now to be more firmly founded than ever before. Samples were also presented of piles which had been nearly destroyed by the teredo, and of others, creosoted, which had been unharmed, though side by side with the others. The creosoting was effected by the Hayford process.

In connection with this paper the model of the Gulf of Mexico, which was prepared by Mr. Hilgard, of the United States Coast Survey, from deep sea soundings, was exhibited. This model, inclosed in a case 23 by 30 inches, is prepared in plaster of Paris to a scale of $\frac{1}{1000000}$, the vertical scale being 1,000 fathoms to 1 inch; the ratio of vertical scale to horizontal being = 0.03. It shows the coast line from Jacksonville, Fla., on the east to Key West, thence along the Gulf States, Mexico and Yucatan, together with the west and north coast of Cuba. Contour lines showing soundings at 10, 100, 500, 1,000, 1,500 and 2,000 fathoms are shown, with the various elevations at different localities in the area described. It is a very instructive and interesting map of this interesting region, and is an acceptable addition to the collection in the rooms of the Society.

We have taken from the bulletin board of the Society the following notices, which explain themselves, and show some of the advantages of membership:

The American Society of Civil Engineers now contains nearly 600 members. In order to increase its usefulness, while maintaining its high standard of requirements, it desires to draw to itself a larger proportion of those engaged in engineering and kindred pursuits, who are estimated to number about 8,000 in this country.

It is suggested that you may be able to propose the names of worthy persons for new Members, Associates, Juniors and Fellows.

A few blank applications for membership are herewith inclosed and more will be furnished if desired.

JOHN BOGART, Secretary Am. Soc. C. E.

JANUARY 31, 1880.

SIR: In order that members, more particularly non-residents, may better avail themselves of the facilities of the Society in New York, the Secretary is authorized by the Board of Direction to state that he will assist in procuring such professional information as may be asked for.

If members will address him concerning data required by them, reference to engineering books or works, the elucidation of particular subjects, or other information which they may desire, he will consult the library of the Society, or members who are experts upon the subject presented, and endeavor to furnish the information desired, or to indicate where it is to be found.

So far as practicable such services will be rendered gratuitously. When, however, they involve expense for copying drawings or extracts from books and papers, or the surrender of considerable time by the Secretary or the members whom he may consult, a charge will be made therefor, but in such cases an approximate estimate of the cost will be submitted to the member applying for the information, and his instructions asked for before incurring the expense.

Communications to be addressed to

JOHN BOGART, Secretary.

DEAR SIR: The Secretary of the American Society of Civil Engineers begs to inform you that a record will be kept hereafter, at its rooms, of the members of the Society who may inform him that they are open to new engagements, together with a statement (furnished by such members) of their previous engagements and experience, and of the positions and compensations desired.

Should you at any time require the services of Civil Engineers, the statements on record of those who would be apt to fill the requirements for your service will be sent you without charge, on application.

The intervention of the Secretary is intended only to give employers and members desiring engagements information as to each other's requirements and views. Very truly yours,

JOHN BOGART, Secretary Am. Soc. C. E.

PERSONAL.

Samuel E. Carey, General Passenger Agent of the Chicago, St. Louis & New Orleans Railroad, died on the morning of the 26th ult., in New Orleans.

Mr. Charles M. Levey has been appointed Assistant Superintendent of the Iowa Division of the Burlington & Quincy Railroad, with head-quarters at Burlington.

Edward D. Adams, Charles F. Woerishoffer and Gen. G. M. Dodge have been appointed a sub-committee to draw up a plan for the union of the various Mexican railway interests.

The President, General Sherman, Secretary Ramsey, Postmaster-General Maynard and Third Assistant Postmaster-General Hazen and Mr. R. P. Hayes, were present at the re-dedication of Pardee Hall, Easton, Pa., on Tuesday.

Colonel J. R. Shaler, formerly Superintendent of the J., M. & I. railroad, and now Assistant General Superintendent of the L. & N. Railroad, has, it is understood, sent in his resignation. After leaving the road he will remove to St. Louis to engage in business.

Galusha Maranville, a mechanic and an inventor of some note, and patentee of a well-known calendar clock and other articles, was killed, Nov. 23, by falling into the fly-wheel in the engine-room of the Charles P. Harris Manufacturing Company, Rutland, Vt.

Professor James C. Watson, Director of the Observatory of the University of Wisconsin, died at Madison, Wis., on the morning of November 28, after an illness of but three or four days. Professor Watson was born on January 28, 1838, and was therefore nearly 43 years of age. He graduated at the University of Michigan in 1857, remaining there as instructor and Professor of Mathematics and Astronomy till 1863, at which time he was made Director of the Ann Arbor Observatory. He held this position till 1878, when he accepted the Directorship of the Washburn Observatory at Madison. He made observations upon the total solar eclipse of 1869, in Iowa, and that of 1870 in Sicily; and in 1874 had charge of the very successful American Expedition, which observed the transit of Venus at Pekin, China. In 1870 he received the Lalande gold medal from the French Academy of Sciences, for his various astronomical works and discoveries. His most elaborate writings are: "A Popular Treatise on Comets (1860)" and "Theoretical Astronomy; relating to the Motions of the Heavenly Bodies revolving around the Sun in accordance with the Law of Universal Gravitation, with Numerical Examples and Auxiliary Tables (1868)." In addition to these, he has published from time to time, in *Gould's Astron. Journ.*, *Astron. Nach.*, *Am. Journ. of Sci.*, etc., short papers relating, for the most part, to the discovery and observation of asteroids, and the computations of comet orbits. For several years he gave especial attention to the search for asteroids, and in this work was eminently successful, discovering, in all, twenty-one of these bodies, between the years 1863 and 1877. At the time of his death, Professor Watson was engaged in building and equipping one of the finest observatories in America. The meridian circle, which is to contain several new features suggested by himself, is now in the hands of the Clarks, and will not be finished, probably, for nearly a year. Other instruments of the highest order are either already mounted and in operation, or are in course of completion. Careful preparations have been made, also, for a systematic search for the planet Vulcan, a problem in which Professor Watson was deeply interested.—*Science.*

A SUCCESSFUL AQUEDUCT OF LEAD PIPE.

BY R. FLETCHER, PROF. OF CIVIL ENGINEERING, THAYER SCHOOL OF CIVIL ENGINEERING, DARTMOUTH COLLEGE.

[Written for Engineering News].

Information relating to aqueducts of considerable magnitude, *i. e.*, exceeding six inches or a foot in diameter, is abundant and accessible, both as to theoretical requirements and practical details; but in the numerous treatises, "papers," reports, etc., on water-supply which are known to the profession, little or nothing is given in regard to lines of small magnitude, *i. e.*, from six inches down to two inches or less in diameter, suitable for villages

and small communities. Whatever practical experience has been gained in various parts of the country is known, generally, only in the local circle of those directly interested.

Undoubtedly there are many villages of a few hundred inhabitants in which the necessity for a systematic water-supply is keenly felt, but the accomplishment of the desired end seems to be impractible. Perhaps there are not a few where all conditions are favorable for securing this boon, except mistaken ideas concerning the magnitude, cost and financial future of the undertaking. It may be that in many such cases, if definite results of experience in other communities could be made known, enterprising persons would be glad to execute what would prove a great public benefit, as well as a profitable investment for themselves.

With the hope of offering such incitement and of showing how readily such benefits may be secured, even on a small scale, the writer presents a brief history and description of an aqueduct line of lead pipe, one and a half inches in diameter, which has been in successful operation more than half a century. This service has required no expensive reservoir, no excessive outlay for maintenance, and has paid good dividends on the investment. The village of Hanover, Grafton Co., N. H., the seat of Dartmouth College, is situated on a terrace or plain about half a mile distant from, and from 140 to 170 feet above, the Connecticut River. The site is divided into two parts by a rocky ridge which culminates in "Observatory Hill," about 100 feet higher than the plain. On the west of this ridge some attempts to dig wells of reasonable depth yielded no result, and those that have been successful generally give hard, disagreeable water. On the east side of the ridge are only a few wells which afford good water. Therefore the supply from wells was not adequate or satisfactory. Manifestly the altitude of the plain made it impossible to draw from the river, except at an expense not to be thought of by a small community. The population probably seldom, if ever, reaches an aggregate of 1,000 persons, including visitors, and students in attendance at the college and the professional schools. In former years the number of permanent and transient residents was not so large as at present. Hence the problem was to secure a sufficient but moderate supply of good water at an expense which a small and not wealthy community could afford.

After considerable investigation a sufficient source of supply by springs was found, and the Hanover Aqueduct Association was incorporated by an act of the Legislature of New Hampshire, Dec. 12, 1830. During the following year the association was organized with a capital stock of $5,000, divided into 50 shares. Each share sold was regularly deeded to the purchaser. The charter secured to the association the right to dig a trench through any land which it was necessary for the line to traverse, to re-open the trench for repairs, to change the position of the line, etc., rights indispensable to the laying and subsequent supervision of the aqueduct. During the 60 years of its existence the association has met all expenses for maintenance, including occasional extensive repairs, renewals and enlargements, and realized an income of from eight to ten per cent. on the investment. At intervals of eight to ten years, when unusual outlays exceeded the amount of any accumulated surplus, it has been necessary to pass dividends for one or two years.

Source.—The source of supply, to describe it in its present state, is a series of four wells or springs near the foot of a steep wooded hillside, where the soil is saturated with water over a considerable area. The association now controls 35 acres of the slope above and around the wells. The latter are from four to six feet in diameter and from eight to twelve feet deep, lined with stone laid without mortar. From three of the wells the water is led to the fourth and lowest one, whence it passes into the aqueduct pipe through a strainer of sheet metal with fine perforations. These wells were never known to fail in the driest seasons, and there has always been a large amount of waste water, forming a considerable rill, flowing from the ground in the vicinity of the wells, since they were made. It is proposed to retard and retain this surplus, if future demand should require, by building a deep trench wall of stone and cement along the foot of the slope and just below the wells, and thus to increase the reservoir capacity without great expense.

The Line.—This is about two miles long from the wells into the heart of the village. After leaving the main well the pipe descends about 60 feet in the first 1,000 feet, when it crosses a brook, which at this point flows over a bed of solid granite. The pipe is carried across in a box of plank, laid on the rock and held in place by large bowlders. Although this box is seldom wholly submerged, only when the brook is running very full, there has never been any trouble by freezing, even in the severe climate of this part of New England, where the thermometer sometimes indicates 35° below zero (F.). From this point we will describe the line as it was previous to October, 1880.

After the above mentioned brook is passed the surface is much broken by knolls and gullies, so that a level line must be very sinuous. The generation which laid the first line, moved perhaps by false notions of economy, or being very straitened as to means, made the course as direct as could be tolerated, and heroically surmounted the knolls and descended into the gullies, making thus, in course of a mile, several vertical bends in the pipe, and causing differences of level of from five to fifteen or twenty feet. About 6,000 feet from the springs the spur of what is called "Sand Hill" is passed, and the line then rapidly descends about 70 feet in the next 2,000 feet to the borders of the village. Here the pipe is about 110 feet below the springs. It then ascends into the village about 50 feet to the highest point of delivery, so that at such point the hydrostatic head from the springs is from 50 to 60 feet.

So large was the friction-head, and so great the obstruction to flow caused by accumulation of air and other consequences of the faulty vertical alignment just described, that at the higher points of the village there was occasional interference with the regularity of delivery, even with a total head of 60 feet, a far less efficiency, indeed, than might have been secured under the ordinary condition of the *hydraulic head.*

The weight of the old pipe was as follows; 2½, 3 and 4 lbs. per foot for heads, respectively, of 50, 80 and 95 to 110 feet. In those days it was made in short lengths of about 12 feet; hence required a great deal of jointing. The weakest points of the old line were the joints, which were not made with sufficient care and thoroughness.

The Service or Operation.—A few years ago, in anticipation of an enlargement of the capacity of the aqueduct, the main line within the village limits was renewed by a two-inch pipe in place of the one-and-a-half-inch before used. The branch and service pipes have diameters of one-half inch and less. The system of delivery is that of gauges. Into the end of each service pipe is soldered a copper butt, which has a square termination detachable by means of a screw joint. In this removable end is a small hole sufficient to admit the passage of a medium sized sewing needle.

The daily allowance to each consumer, or one "share," is 40 gallons, but under ordinary conditions the actual delivery exceeds this amount. The consumer provides means for receiving and storing the supply, generally by a good cistern of greater or less capacity. The ordinary requirements of a small family usually leave a surplus so that a large cistern can be kept full when the line is in good working order, and this reserve be made available in times of temporary stoppage or deficiency in the flow. In cases where consumers require more than one daily share and endeavor to obtain it by tampering with the gauge, either by removing the end or enlarging the orifice, a fine is imposed. Formerly the higher points of delivery were very sensitive to any such interference, as a small diminution of pressure would stop the flow there at once. In all cases of stoppage or interference of flow by accumulation of air, tampering with the line at one or more points, accidents, etc., the services of an *overseer* are called for to apply proper remedies. This functionary, having acquired a thorough acquaintance with the line by years of service, generally is able to discover at once the cause of any difficulty. He makes occasional inspections of the points of delivery, besides, so as to see whether all is in proper working condition. For all such labor the association pays him by the day or hour for the time actually employed. The overseer acts under the orders of a general superintendent, who authorizes whatever is to be done. The other officers are such as usually constitute similar organizations, and they serve without compensation. The number of "shares of water" furnished by the line at the beginning of the present year was about 150, each nominally 40 gallons per day The charge per share was originally six dollars yearly, increased during several years past to eight dollars, but recently reduced to six dollars.

The water is excellent spring water, containing a sufficient amount of carbon dioxide in solution to cause a rapid formation of carbonate of lead upon the interior of the pipe. No case of lead poisoning has ever occurred in Hanover from the use of the water supplied by the aqueduct. Specimens of the old pipe which have been in use 52, 26 and 3 years have this inner lining of insoluble carbonate well developed, and careful weighing of old pipe which has been recently taken up does not reveal any diminution of weight, even during the longer periods of service.*

A New Line of Pipe.—The old line of one-and-a-half-inch pipe has not been adequate to the demands of the village for several years past. There was a continual waste of water at the wells, forming quite a rill even in dry seasons. Doubtless the delivery would have been much larger through the same pipe, if a better profile had been adopted. The association determined to re-lay the entire line with two-inch lead pipe, and this was successfully accomplished during September and October of this year. The means were obtained by increasing the capital stock from $5,000 to $10,000. Great attention was paid to securing a good profile. Throughout the mile of old line where the vertical bends were so numerous and frequent, the new line was laid practically level, although to accomplish this end it was found necessary to increase the length and at one point to dig the trench from eight to fourteen feet deep for about 300 feet. The weight of the pipe is seven lbs. per foot under a head of 60 feet, eight lbs. under a head of 60 to 80 feet, and nine lbs. per foot under a head of 90 to 110 feet. Cost of new pipe about 6.2 cents per lb., delivered upon the ground. Cost of digging trench and laying pipe, about $1.50 per rod or about $9.00 per 100 feet. The wages of laborers, $1.25 per day. The average depth of trench, four feet. An entirely new trench was dug, as the old line could not be disturbed until the new line should be brought into use. No blasting of rock was necessary, but numbers of large bowlders were encountered and removed by a machine consisting of a combination of geared wheels suspended from a tripod and worked by an endless chain. The new pipe was delivered on reels in lengths of 100 feet, and rolled off from the reels directly into the trench. The joints were made by swedging one end and inserting the other chamfered end about two inches, and for each joint about six-tenths of a pound of solder was used. Iron pipe would have been cheaper as to the pipe itself, but would have cost more when laid. Moreover it presented objections, viz.: too great rigidity as compared with

*Specimens of the old pipe, showing the inner coating formed as well after 3 as after 50 years of use, may be seen at the rooms of the American Society of Civil Engineers, 104 East Twentieth st., New York City.

lead, far more numerous joints, necessity for laying it in straight lengths, rusting, etc.

When the water was first turned into the new line the time required for it to traverse the first 6,000 feet, including a descent of 60 feet in the 1,000 feet nearest the well, an ascent of four or five feet at the brook and 5,000 feet on a level, to the regulating valve on Sand Hill, was almost exactly half an hour. The last 3,000 feet to the valve on the outskirts of the village, including a descent of about 55 feet and a rise of about 30 feet was passed by the head of the stream in a little more than 20 minutes. With the same velocity of flow as in the old pipe the capacity of the new would be to the old as sixteen to nine. Considering the diminished friction, improvement of the profile, etc., the least sanguine anticipation was that the new line would deliver between two and three times as much water in a given time as the old line did; but the actual capacity proves to be even greater, from three to four times. Indeed, under full pressure the old gauges would furnish more than three times the usual allowance, and it has become necessary to keep the regulating valve turned down to within one turn of an entire closure, whereas, nine more turns are required for a full opening.

The old pipe was dug up at a cost of about 30 cts. per rod or $1.80 per 100 feet, and netted about $1,000 for the entire line of 9,000 feet.

There is reasonable expectation of an increase of 30 per cent. immediately in the number of consumers, and those who have undertaken this enlargement and improvement will receive substantial return, besides the pleasure derived from the conciousness of having directly contributed to a beneficent work to the lasting benefit of the entire community.

CONCLUSION.—Doubtless there are hundreds of villages throughout the country which are abundantly able to provide for themselves, in a similar manner, an equally good or even better supply of the best water. Wherever the proper conditions exist, a little energy and public spirit, exercised even by a few individuals, will suffice to accomplish so desirable a result.

MR. SELLERS ON THE METRIC SYSTEM FOR THE MECHANICAL DRAUGHTSMEN.

In his paper recently read before the Mechanical Engineers, and printed in ENGINEERING NEWS of November 20 and 27, Mr. Coleman Sellers has contributed to the metric discussion a valuable explanation of the difficulties which attend any change of standard in the machine shop, whether to or from the metric system, and of the way those difficulties have been met in the recent very successful introduction of the metric system into Germany, matters which were popularly understood before only in a general way. The subjects of draughting and computing, however, he so befogs that a few simple words of commentary are in order.

He mentions seven scales which he says emphatically are the *only* ones we can use for metrical drawings; and complains that these are not enough. "The jump from one-half to one-fifth size is unfortunate. If we could conveniently quarter the whole size we would have an increased area section, a matter of much moment." Then why, in the name of reason, should not we do so? We can use a scale of 25 per cent. of full size, as conveniently as we can use a 25 cent piece or a 2½ dollar piece in federal money. Does not Mr. Sellers know that our currency is decimal? Well, take what he does know: the metric system is nothing if not decimal; and the graduations of any metric scale, which on one drawing represent certain dimensions, on another drawing perfectly represent ten times those dimensions. Now, one of his seven metric scales is one twenty-fifth (or $\frac{4}{100}$, to speak decimally), which he expressly states may be constructed; with that in his hand he can use it just as well for a scale of $\frac{8}{10}$. This is a second stepping-stone in his chasm, between $\frac{8}{10}$ and $\frac{5}{10}$. If he wants a third stepping-stone he can take $\frac{3}{10}$. The marks for 8mm. and 4mm. are just as plain on any rule as the mark for 2mm.; and like it they can be taken to represent 1 centimeter, 10 centimeters, 1 meter, 10 or 100 meters, or 1 kilometer. Here comes in the advantage over the old practice; for when a quarter of an inch is taken to represent an inch, as it is by the machinist, he wants it divided by successive bisections; when it is taken to represent a foot, as it is by the architect, he wants it divided duodecimally; when it is taken to represent ten feet, as it is by the surveyor, he wants it divided into ten parts; so that three different draughting scales are desirable for the use even of the commonest of all scales.

Mr. Sellers claims it as an advantage of the inch dispensation that it gives a multiplicity of scales. He mentions, for instance, that we can use $\frac{1}{48}$ and also $\frac{1}{50}$. What earthly good is there in having two scales so nearly alike? If one of them is big enough or small enough, the other will be also, in any ordinary case. These needless variations simply depend upon the permission of several incongruous methods of subdivision, which is a perpetual source of annoyance, despite Mr. Seller's assurance that they "lead to no confusion." Probably every reader has a painful recollection of the interconversion of 16ths and decimal fractions of the inch, let alone duodecimals.

Mr. Sellers presents a series of customary scales having the peculiar merit that each is twice as large as the next; the following series of standard metric scales possesses the same merit:

.025 .05 .1 .2 .4 .8

Yet he italicizes the assertion that the manifest advantage of the inch series "*admits of no dispute.*"

About computation, Mr. Sellers' remarks are still less adequate, though not so audacious. He compares the multiplication of 1.5m. × 1.5m. × 3 m. with that of 5 ft. × 5 ft. × 10 ft., which would be fair if we had decimalized the foot and abandoned the inch. For a real comparison with what is now in use, let him take 1′ 5″ × 1′ 5″ × 3 ft., and see whether his carpenter will reckon it in his head. He says again: "I must confess I see no difference in favor of hunting up in books the specific gravity of matter, or in looking for the weight of matter in pounds per cubic inch, or foot, or yard." Such humility deserves assistance; the difference is, dear sir, that not all of those items are found in English tables; sometimes only one of them is given. If you find the weight per cubic foot when you want the weight per cubic inch, you have to divide by 1,728; if you find the weight per cubic inch when you want the weight per yard, you have to multiply by 46,656. In the metric tables, on the other hand, the specific gravity is at once the weight in kilos per liter, the weight in grams per cubic cent., and the weight in metric tons per cubic meter.

Mr. Sellers declares as if it were a conclusive argument: "I have yet to see the example of a metric-educated draughtsman working in millimeter calculations on an inch-measured machine." Of course, the metric man is not such a fool as to suppose that the inch and the millimeter can be mixed up with advantage.

He speaks also of the want of metric hand-books in the English language containing formulas and various data. There is no occasion for anxiety on that score; when the demand becomes active, the supply will doubtless be forthcoming.

His chief point of vantage appears to be the very serious difficulty of changing the Wm. Sellers, or Franklin Institute, or United States standard of screw-threads; but the force of this argument was somewhat broken on the day after it was uttered by the discussion that took place in the American Society of Mechanical Engineers, showing that the screw-threads now in use in this country are far from conforming to any system. Mr. Forney, of the *Railroad Gazette*, is quoted as giving this illustration:

"A railroad, not long since, ordering some thousand cars, specified that the bolts and nuts were to be of the Franklin Institute standard. When the cars were delivered it was found that the nuts and bolts were not interchangeable with those already in use, except the larger nuts on the smaller bolts. Investigation showed that the works which built the cars had purchased new taps and dies, said to be standard, for that especial work; but, on comparison, it was found that these did not agree with certain other standards."

Mr. Sellers confines himself avowedly to the machine-shop, shutting his eyes to what is going on outside of it. In the matter of weights and measures, which is directly connected with an endless variety of human activity, it might prove advantageous, even in regard to his own specialty, to take a broader view.

F. B.

BOSTON, Nov. 30, 1880.

RECENT FIELD BOOKS.

THE FIELD ENGINEER; a Handy Book of Practice in the Survey, Location, and Track-Work of Railroads; Containing a Large Collection of Rules and Tables, Original and Selected, Applicable to both the Standard and the Narrow Gauge, and prepared with Special Reference to the wants of The Young Engineer. By William Findlay Shunk, C. E. D. Van Nostrand, New York. 1880.

FIELD ENGINEERING; a Hand-Book of the Theory and Practice of Railway Surveying, Location and Construction; designed for the Class-Room, Field and Office, and containing a large number of Useful Tables, Original and Selected. By Wm. H. Searles, C. E., Member American Society Civil Engineers Jno. Wiley & Sons, New York. 1880.

Both of these two books are closely modelled upon "Henck," but both of them enlarged and modernized. Singularly enough they are, we believe, the first attempts, in all the twenty-six years since Henck first appeared, to furnish improvements on that volume, which shall at the same time be in all respects acceptable as a substitute. Several have been published, but owing to deficiencies in the tables, if nothing else, they have all fallen comparatively flat, and "Henck" has maintained its pre-eminence, and maintained it so long that a new author has a very serious task before him to attempt to replace it, even with a better work. This task is about to be made still more difficult, we understand, by the issue of a new and modernized edition of "Henck."

It is a current proverb among publishers that no book will sell largely to engineers unless in pocket book form, and if this be somewhat a slander it is certainly true that pocket books are *used* more by almost all engineers for constant reference than any other books they have, and are, in fact, absolutely essential to them, so that the appearance of two new claimants for favor interests the profession very generally and demands of us a careful notice.

It is impossible to even enter upon such criticism, however, without being affected by the remembrance of circumstances which have been justly and feelingly summarized by Mr. Shunk in his preface. The extract will bear repeating, and we will quote it in full.

"In dismissing the work from his hands the precarious snatches of time occupied in its preparation, by day and by night, which might have been more agreeably spent in reading, talking or musing, recur to the writer's mind; and the thought arises, To what end or from what motive do people undertake these technical labors? The ordinary motives to endeavor here have no place. There is neither fame nor profit in these drudging enterprises. At best the author gives name to his work; he himself remains impersonal—known but indirectly and but to a class. How, then, shall we account for his labors? I take it the Father of mankind has not only made our minds to hunger for knowledge as our bodies for food, but has also imposed on us a kindly law of communion by virtue whereof we cannot do otherwise, without violence to generous nature, than share with our fellows whatsoever we have learned that seems new or useful.

"Though the present writer would not arrogate to himself equal fellowship with the eminent brotherhood named, yet he may justly claim like pureness from unworthy motive, and certainly feels like comfort at heart to that which they