AMERICAN INDUSTRIES.—No. 88.

THE MANUFACTURE OF STEAM ENGINES AND AGRICULTURAL IMPLEMENTS.

The celebrated manufacturing town of York lies in the famous agricultural region of the Codorus Valley, in Southern Pennsylvania, between Philadelphia and Baltimore, and is about five hours by rail from New York city. Its most important industry is the manufactory of steam engines and agricultural machinery known as the Pennsylvania Agricultural Woks, owned and managed by A. B. Farquhar. These works were founded by Mr. Farquhar a quarter of a century ago, and additions have been made from time to time until they now fairly rank as one of the most complete and extensive establishments, for the production of machinery and implements, not only in the United States but in the world. The works were designed especially for the manufacture of improved machinery and agricultural implements, with tools adapted to every part of the work; and having the benefit of abundant skilled labor at moderate cost (owing to low rents, good markets, and healthy location), and being contiguous to the vast lumber, iron, and coal regions of the country and in easy access of the great cities of New York, Philadelphia, and Baltimore, the proprietor is enabled to offer superior advantages to those needing first class agricultural tools and machinery.

The works cover a number of acres, and embrace machine, engine, and boiler shops, bolt and nut factory, planing and saw mills, foundries for brass and iron, forging, shearing, and polishing rooms, besides warehouses, lumber yards, etc., all complete in itself. Among the specialties are steam engines, saw mills, thrashing machines, plows, agricultural steels, cultivators, grain drills, corn planters, horse powers, etc., in almost endless variety. Some idea of the magnitude of the operations may be formed from the fact that the weekly consumption of iron now averages over 150,000 pounds, and of steel fully 10,000 pounds, and of lumber from 50,000 to 100,000 feet.

The business shows an annual average increase of from fifteen to twenty per cent, necessitating frequent additions to both buildings and machinery. This is a direct result of the principle governing the whole concern—only the best material and most skilled labor are employed, and everything sold is fully warranted; not a single detail is risked by bad work, and if a mistake or defect occur it is promptly made good. The utmost pains are taken at every point to turn out only work of the highest order. As a natural consequence the trade now extends over the habitable globe, and at the time of our visit orders were being filled for nearly every State in the Union, and shipments being made to remote corners of the world. Large additions to the works have been made within the past year, and machinery of the most improved pattern known to the trade has been introduced for the manufacture of each part of the work.

The best relations exist between proprietor and employes, and there has never been a strike in the works. The superintendents and workmen take almost as much interest in the success of the business and quality of the machinery turned out as the proprietor.

No traveling men are employed, the business relying on quality for its maintenance and increase. It is the aim of the proprietor to give full value to all purchasers and to make it a benefit to them to deal with him, and as proof that his efforts in this direction have been successful he points with just pride to his immense and rapidly increasing business. The works ran full handed during the entire period following the financial depression of 1873.

The most competent experts are employed in the several departments, and large sums are expended in order that they may post themselves concerning the wants of different sections and keep the manufactures up to the highest standard of excellence. Many medals from the world's fairs of Europe, our Centennial and State fairs, attest the high regard in which the machinery is held.

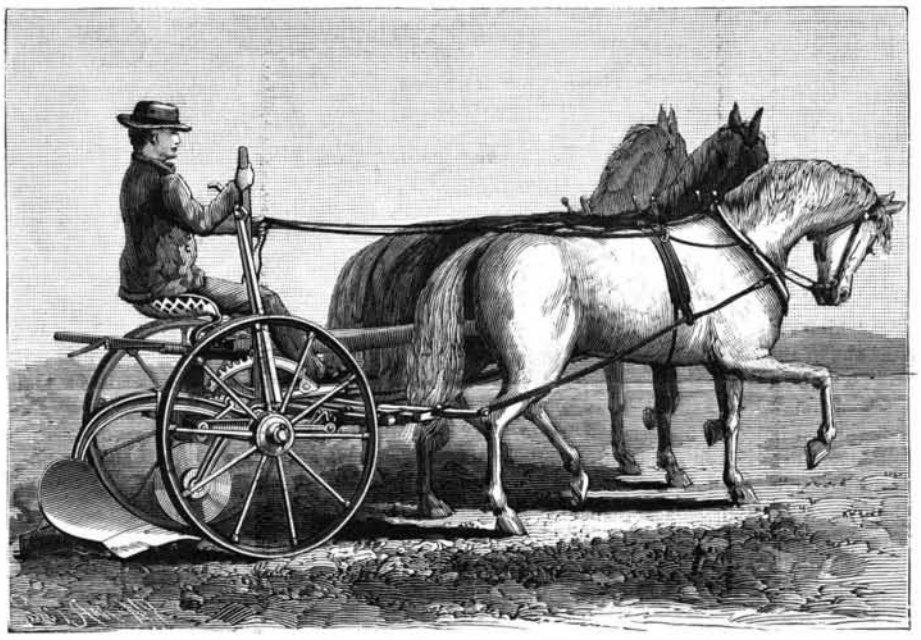
A bird's eye view of the principal factories is shown in our engraving, each department being arranged with special relation to the business pertaining to it. Although it is impossible to give a conception of the size and completeness of the works, some idea may be formed when we say that the total floor space approximates half a million square feet. The view on our title page gives an idea of the arrangement of the shops, some fifteen in number, and some of the leading machines and implements. The buildings are all constructed of brick and iron, with slate or metal roofs. A complete system of water mains, hydrants, and hose pipe protects the works from fire. The wood-working shops are supplied with a system of perforated pipes, so arranged that the entire structure may be deluged with water by turning one wheel. The factories are all lighted by electric lights. Tracks connect the different buildings with the five railroads centering at York. The very best work can be furnished at the lowest price, since all parts of the machinery and implements are made here—the nuts, washers, bolts, steam fittings, etc., belonging to the engines, and the handles, beams, castings, steels, bolts, etc., belonging to the plows and implements.

In addition to the works located at York, the large and rapidly increasing Southern trade necessitated the opening of the branch store and factory known as the Central City Iron Works, in Macon, Ga., now one of the most complete in the South. The large export trade is handled from the store in New York city.

Among the well-known specialties manufactured at these works are the Farquhar Ajax traction and portable engines (the fire-boxes are steel, and the boilers have a remarkable record, not one having ever exploded); the vertical boiler with submerged tubes, arranged with wheels when desired; the Farquhar separator with self-regulating blast, saving every grain; saw-mills with patent feed, set works and dogs of most improved kind. Among the leading implements manufactured here are the Penna. drill and corn planter, with perfect force feed and phosphate attachment, and Farquhar's celebrated wheel or sulky plow.

Farquhar's Ajax Traction Engine has several important patented advantages. The boiler is made of steel, and is so constructed that it is impossible for the crown-sheet to become exposed, even on the steepest grades. A steam guiding attachment enables the engineer to steer with ease, by the simple movement of the lever. The wheels are of a most improved pattern, strong, durable, and of a handsome design. Springs are placed in the hubs of the wheels, acting as a cushion between the engine and gearing, and supporting the weight and avoiding jarring when passing over an obstruction. A neat cab covers the platform, protecting the engine and engineer from storms or hot sun.

The Ajax Portable Engine is of the center crank type, and possesses strength combined with simplicity. The pedestals and cross-head guides are cast solid with the bed-plate, thus making it impossible for the engine to work out of line or give. The cranks are made of the best steel. The fire-boxes of the boilers are made of steel, of the same brand as that used by the Pennsylvania Railroad in their locomotives. The rest of the boiler is made of the best charcoal iron.



FARQUHAR SULKY PLOW.

The Vertical Engine is very popular, being light, convenient, and cheap, and is as good as the horizontal where light power, from two to six horse, is required where used for thrashing grain or other portable purposes. The boilers are provided with two trunnions and wheels. The tubes are submerged. The engine and boiler are carefully made to insure durability and strength.

In the Farquhar Improved Saw Mill the patent feed, set works, and dogs and head blocks are all of improved form; the saw shaft is steel. It is stated that some of our large lumbermen have found it economical to throw out their old mills and substitute this.

The Farquhar Separator is so well known as to need but little description. It was awarded the first premium and medal at the Centennial and Paris expositions on account of its lightness of draught, rapidity and economy of work. Owing to its self-regulating blast, which cleans the grain ready for market, the chain elevator which cannot be choked, steel shafts and spikes, it possesses advantages of the highest order.

Farquhar's Wheel or Sulky Plow does work better, cheaper, quicker, and with infinitely more ease than the walking plow. Its special advantages are simplicity of construction, effective work, steel beam. It has a positive self-lifting attachment, adjustable hub box, light, strong, and handsome wheel, and may be easily and readily adjusted from two to three horses. It is constructed wholly of iron and steel. It has sliding axles, is light draught and is most durable, although weighing less than the others in use. In construction, adjustment, and ease of management it is superior.

Many other improved implements were being turned out in great quantities when we visited the works. We have only space to speak of a few which particularly attracted attention. The Geddes hinge harrow is one of the best in use. It draws from the center, is easy on the team, and being hinged it works as well on uneven land, and is easily lifted when in motion, to discharge weeds, etc. It is strong and durable, and can be doubled in a portable form. The teeth are prevented from getting loose by being fastened with nuts and washers. Harrows constructed upon other plans, but all showing the same degree of good workmanship, were noted.

The Farquhar improved cotton planter is very simple and perfect in its operation, dropping the unrolled seed with remarkable regularity and in any desired amount. The Keystone corn planter will plant from ten to twelve acres of corn per day, dropping kernels in drills or in hills, at any desired distance apart, and sowing at the same time, if needed, any kind of pulverized fertilizer. The Pennsylvania force-feed fertilizer grain drill will not only sow the grain evenly, but, what is an equally important feature, it will distribute the phosphate with the same precision, doing the work without any loss of either seed or fertilizer.

The Farquhar Hoffheins mower and reaper possesses many points of excellence. The frame being of solid iron and very compact holds the shafts securely in position and is supported by two ground wheels, either or both of which drive the machinery. The self-rake, moving automatically, will make the bundles at regular intervals, their size being regulated by means of a treadle convenient to the driver's foot. The height of cut can be regulated while the machine is in motion; the guards can be thrown down, so as to run under the fallen grain, or elevated to pass obstructions.

Farquhar's climax horse-power, for thrashing, ginning, and general farm use, is triple geared, the strain being divided so as to prevent breakage or wear. All the gearing is connected by one strong iron frame; the levers are so arranged that the strain of the team is thrown upon iron braces, and can be taken off or put on in a moment without loosening a bolt. All the boxes are self-oiling. This horse power is strictly portable and can be quickly and easily set up by ordinary farm laborers. Corn shellers adapted to hand or horse power, farm mills, standard grinding mills for corn, wheat, and other grains, fodder cutters, cider mills, farm and freight wagons, etc., are turned out in almost endless variety.

We have not the space to even enumerate them. All the various parts of the agricultural implements and the steam engines and boilers—including bolts, nuts, thrasher spikes, wrenches, plow irons, and forgings of all descriptions, and valves, cylinder lubricators, water gauges, air cocks, steam whistles, inspirators, etc.—are turned out at these works.

Further particulars of this manufactory and the work it produces may be obtained from the large illustrated catalogue, which will be furnished upon application by the proprietor, Mr. A. B. Farquhar, York, Pa.

Lathe Pulley Faces.

Machinists have often noticed the edge wear of belts on pulley steps of lathe cones, caused by the riding or the rubbing of the belt on one step against the rise of the next higher step; and this creeping up notwithstanding the swell or crowning of the face of the pulley step. A recently noticed remedy is one that is applied by the Pratt & Whitney Company, Hartford, Conn., on all their lately built lathes—a remedy as simple as it is effectual. The crown of the pulley face is not in the center, but on the "off" side, or toward the next lower step, away from the adjoining rise. By practice it has been found that this diversion from the center is too slight to affect the eye, the off on a step of 2⅝ inches for a 2½ inch belt being only one-eighth of an inch; but it is an effectual remedy.

The crowning of the faces is effected by equally simple means. Machinists generally know the Slate taper attachment to lathes, which guides the tool carriage independent of the traverse screw, in turning or in boring tapers. The arrangement for producing the swell is on the same principle, the transverse screw being removed and the upper portion of the carriage with the tool post being held by a flat spring at the back of the lathe against a former, a slightly swelled strip to correspond with the intended crowning of the face of the pulley step. This is the last turning operation on the lathe cone, the former chips being in line or level.

Railroad to Alaska and Ferry at Behring Strait.

A railroad around the world, or something nearly of that nature, is evidently in the mind of one of our correspondents, who suggests the employment of our surplus revenue in building the line from Oregon to Alaska, and that then the Russian government would be likely to extend the line through Siberia to Pekin. This having been done, it requires not much further stretch of the imagination to see, with the mind's eye, the long rails stretching out under the shadows of the Himalayas until they make connection with the proposed line in the Jordan Valley, and thence with the European system.

A CORRESPONDENT in the Government Engineering Laboratory, College Howrha, Bengal, writing in reference to the discoloration of brick walls, says that in three samples of white incrustation he found the substances to be mainly potassium nitrate with a trace of magnesium nitrate.

Correspondence.

Were the "Small Motors" Wrong?

To the Editor of the Scientific American:

Your correspondent "Alia," etc., takes me up about my fourteen foot boat that was going out fishing so nicely with its store of compressed air, laid in a pipe along her gunwale. I never intended to have her driven in any such way as "Alia's" experience in boating indicates. His engine has a 3 x 3 cylinder; this, with a 100 pound pressure, is surely good for a full horse power, and can easily be crowded to double that and more; and yet he can get but a mile in nine minutes.

Now, we will say nothing about increasing that rate, but we will only look for the power needed to attain it. My boat—perhaps his boat is different—but my boat I can pull, with a steady stroke—not the "Yale jerk"—at very nearly that rate, and not expend over one-tenth part of a horse power. Haud inexpertus loquor. What has become, then, of the remaining immense proportion of his engine's power? Plainly it has been wasted some way; mostly, perhaps, by indirect action. Taking the commonly received estimates of the bulk of steam required for a given power and time, one cubic foot of air compressed to the degree assumed by me is sufficient to drive my boat, on the basis of what I can do myself in rowing, not less than seven hours. The length of gunwale of a 14 foot boat is not 28 feet as stated by "Alia," at least I never saw any boats built that way; it takes about 35 feet to go around mine. That length of 2 inch pipe measures over three-quarters of a cubic foot.

By using direct pneumatic propulsion I think I am justified in asserting that the boat can be driven as I formerly stated.

A.

Storage of Wind Power.

To the Editor of the Scientific American:

For quartz, saw, flouring, and other mills, so situated that they can be built on a hill side, so as to furnish a sufficiently strong foundation, there is no power so easily stored, used, and restored as perfectly dry fine sand. The mill can be easily and cheaply arranged with buckets to carry the sand back into the bins, from whence it is taken as wanted through spouts and conveyed to an overshot water wheel of sufficient size to run the machinery required. The sand costs little or nothing but the hauling, is to be had everywhere, sustains but very little waste by use or restoring, and works as well if not better than water. This applies to all the deserts and plains of the West and Mexico. I know of one mill now run by dry sand, and it does good work.

True, water can be used, where it can be had to pump, but the pumps and tanks cost much more than those necessary for sand. Air pumps and compressed air can also be used, but the first cost of the plant is too great. Any carpenter can make all the appliances required for using dry sand, and any farmer, ranchman, miner, or manufacturer who owns a side hill, so as to have a solid foundation for his sand tanks or bins, can use this power with but very small outlay to start with.

X. Y. Z.

The Washington Monument and the Axial Motion of the Earth.

To the Editor of the Scientific American:

Nearly forty years ago the French physicist Foucault furnished a direct proof to enable us to see the earth go round. His famous demonstration caused a great sensation at the time, and will always be known as Foucault's experiment. It is based on the fact that a pendulum once set in motion will continue to swing in the same plane, if it is suspended in such a way that the pivot can turn around and still leave the pendulum free to swing in the same plane, instead of turning with the pivot. The pendulum must be a heavy one and the point of suspension as free as possible from friction. We will suppose such a pendulum placed at the North Pole. If the earth rotates, it would carry round the point of suspension once in twenty-four hours, and also the surface of the earth under the pendulum. If the pendulum did not partake of this motion, but kept steadily swinging in the plane in which it was started, we could see the surface moving round beneath it, though it would appear as if the direction of the pendulum were constantly changing. The pendulum would seem to swing round the circle once in twenty-four hours, while the building in which it hung and the earth on which the building stood would seem to be at rest; but we could have no doubt as to which was the real and which was the apparent motion. At any place between the pole and the equator the experiment would not be so simple, as the point of suspension would be carried round by the rotation, but the direction in which the pendulum swings would seem to be constantly shifting, though it can be calculated just what the change ought to be in any given latitude. If, then, the observed motion agrees exactly with the calculated one, the demonstration is as complete and satisfactory as it would be at the pole.

Foucault made his experiment in the church of St. Genevieve, in Paris. Here he suspended under the dome a pendulum some two hundred feet in length, performing its vibrations in eight seconds. A graduated circle was drawn on the floor beneath it, and hour after hour and day after day the measured swing of the heavy ball was found to be precisely in accordance with the theory that the earth turns on its axis once in twenty-four hours. The apparent changes in the direction of its motion were explicable in no other way, and the hypothesis was thus demonstrated beyond the possibility of doubt. The globe on which we dwell was seen to go round, and Foucault was the scientific hero of the day.

The idea recently occurred to the writer while viewing the Washington Monument that a grand opportunity was there presented for repeating Foucault's experiment, as a pendulum of any desired length could be employed, and with the aid of our most perfect appliances it could be carried out on a scale which would secure the most satisfactory results, and it would add another feature to the many attractions which already bring visitors thousands of miles to the capital of the nation.

S. L. DENNEY.

Strasburg, Lancaster Co., Pa., December 24, 1883.

Blowing up Tornadoes.

To the Editor of the Scientific American:

In your issue of December 8, John F. Schultz has a scheme for changing the track of tornadoes—by blowing them out of existence. A cyclone is meant, I suppose, for a tornado is properly a "straight blow." There are several objections to his method of changing a cyclone's course. If one of these whirlwinds traveled in a straight line, and always on the ground, his plan would be feasible; but as a cyclone often jumps or bounds along, and seldom travels in anything like a direct course, one would scarcely know where to locate his keg of powder; and if he knew, he would not have time to do it. In fact, by the time the powder was in place the cyclone would probably be in the next county. How are we to do if the cyclone comes at night, when it cannot be seen? Even if some one had nerve enough, on seeing a cyclone, to put a keg of powder, as near as he could judge, in its path, the whirlwind would probably miss the powder and blow the man out of existence. About the best plan is to get into a "dug out" when there is danger of a cyclone, and in the western and central parts of this State almost every farmer has one.

BERT DAVIS.

Topeka, Kansas, December 17, 1883.

"The Brandy Bread Company."

To the Editor of the Scientific American:

In your issue of the 22d is an article with the above heading. The object of the Brandy Bread Company is to obtain alcohol from bread in the process of baking.

In the course of fermentation the dough passes through four processes, if the fermentation is allowed to go on, viz.: saccharine, vinous, acetic, putrefactive. The dough should always be put into the oven before it passes through the first fermentation; the bread in that case will be good, having the sugar in it. If allowed to pass into the vinous fermentation, so as to obtain alcohol from it, the bread will be poor in flavor and in quality.

N. D.

Portland, Me., December 22.

Cost of Producing Beef.

The report of the Committee on Cost of Production, at the late Chicago Fat Stock Show, goes extensively into the question of the proper basis on which awards at such exhibitions should be made. In order that the results might be determined solely upon the quantities of the various kinds of cattle food used, as well as the skill of the feeder, the price of each article of food named in the statements was determined upon an equitable and uniform basis to all the competitors, as follows:

Value of calf at birth	$5.00
" milk, per gallon	.04
" shelled corn, per 100 lb	.71
" corn in ear, per 100 lb	.53
" soft corn, per 100 lb	.50
" oats, per 100 lb	.75
" corn meal, per 100 lb	.80
" corn and oats, per 100 lb	.80
" shorts, per 100 lb	.70
" bran, per 100 lb	.60
" oil meal, per 100 lb	1.25
" oil cake, per 100 lb	1.25
" hay, per 100 lb	.30
" pasturage per month, up to 12 months	.75
" " " 12 to 24 months	1.00
" " " 24 to 36 months	1.25
Expense for care, feeding, salting, and interest, up to 12 mos.	4.00
" " " " " 12 to 24 mos.	6.00
" " " " " 24 to 36 mos.	9.00

The great diversity of articles consumed by the competing animals, as well as the methods of handling stock, made it somewhat difficult to determine upon the comparative value of some of the articles of food named for the most rapid production of beef, the quality of which could not be satisfactorily determined until the carcasses are displayed upon the block. The prices of grain, etc., named were not the present market price, but a fair average for a term of three years. The value of calf at birth, pasturage consumed, and expense for care, etc., were rated the same with each exhibitor.

The committee recommended that for the future greater care be given by exhibitors in their statements as to quantity of each article of food consumed, exact time that animals were on pasture or stock fields, and details of expense for care, etc., to enable a more careful comparison to be made of the various methods of feeding and the effect of same upon the animals. Attention was also called to one of the lessons to be learned in the statistics presented, viz.:

If feeders desire to keep their cattle for feeding beyond two years, the most profitable results have been obtained where the animals have been liberally fed the first year on a coarse diet that will develop bone and muscle upon which to build the matured carcass. The most economical production of beef does not always result from strong feeding of grain or concentrated food during the first twelve months of age of the steer.

The committee strongly urged upon feeders the importance of liberal feeding from birth of calf, and giving more attention to the important matter of early maturity. The figures clearly demonstrate that the greatest profit results of the feeder in marketing cattle at an early age, not exceeding twenty-four months.

Our Losses by Fire.

According to the *Fireman's Journal*, which quotes from the *Commercial Bulletin*, the losses by fire in this country during the first eleven months of the present year have been about ninety-two millions of dollars, and it is probable that the total of losses for the year will reach the round sum of one hundred millions. If we add to this the expense of maintaining insurance offices and agents, we shall find that the cost of combustible construction, carelessness, and incendiarism in the United States has this year been at least one hundred and fifty millions of dollars. We are often told that by the "blessings of insurance" this enormous burden is "distributed" so as to be "unfelt." In other words, the man who builds the cheapest and most combustible warehouse that he can, fills it with valuable goods, and then sets it on fire, either intentionally or by carelessness, gets back the value of his building and goods in cash from the underwriters, and they again collect what they pay out, together with as much more for their own salaries and expenses, by levying a tax upon all the buildings and goods, which is finally added to the price of the goods, and paid by the consumer. To take a single example, the cotton manufacturer pays, in the price, the cost of insurance on the raw cotton until it is delivered at his mill, and a further premium upon the same while in process of manufacture, and upon the buildings in which it is manufactured, with the machinery in them. All these form a part of the cost of manufacture, and are added to the price of the product. From the manufacturer the goods go to the commission merchant, who also pays a premium for insuring them and the building in which he stores them; and from him they go to the jobber and the retailer. Each one of these keeps them, as well as his own warehouse, covered by insurance, and adds the cost to the price of what he sells. Supposing a year to elapse between the gathering of the cotton and its delivery in the shape of cloth to the consumer, the enhancement in cost, to pay the expense of insurance alone, will be, as a rough average, about two per cent. Every other manufactured article bears a similar tax, in many cases, where the production and sale are slow, amounting to 10 or 15 per cent instead of two; and even raw produce is somewhat burdened. Since the impost bears upon all alike, each person endeavors to reimburse himself by asking a little higher price for his labor, so that in the end the insurance burden diffuses itself as a nearly uniform tax of about two per cent upon the total annual expenditure of every family in the country.

Viewed in this light, the insurance tax is not so "insensible" as some would have us believe. To state the case in a little different way, every man or woman in the community who is paid for his or her labor works one week in every year as a gratuitous contribution toward paying the salaries of insurance agents and the fire losses caused by carelessness or crime. Returning again to the original estimate, and setting the total cost of fires and insurance in the United States at one hundred and fifty million dollars a year, we will divide this sum by the number of families in the country, which would be, by the usual reckoning, about ten millions. Ten million families, to raise a hundred and fifty million dollars a year, must pay fifteen dollars apiece, on an average. Taking into account the climate and circumstances of all portions of our territory, it may be safely asserted, we imagine, that fifteen dollars for each family would pay the cost of all the wood and coal used for household cooking and heating throughout the United States; and a transformation in methods of construction, by which conflagrations would be rendered, if not impossible, at least as rare as in some countries, would be a direct pecuniary benefit, equaling in value a perpetual gift to every family in the republic of all the fuel needed for domestic use.—*American Architect.*

Crushing Properties of Wet Snow.

Wet snow on roofs has been causing much inconvenience and many accidents of late. The extra weight to be supported in such contingencies seems not to be sufficiently calculated upon by builders. The snow is so light as it generally falls, taking eight to twelve cubic inches to equal the weight of a cubic inch of water, that people do not generally realize how this same snow, becoming saturated by gentle rains, and added to by successive snow falls, may finally pile up an aggregate weight. Old and leaky roofs, and especially those which are flat, or have only a slight pitch, should be promptly relieved of this extra burden on the occasion of every considerable fall of snow, for if not crushed they may, nevertheless, be deflected enough to crack or loosen the covering, and thus develop leaks. Flat roofs especially, should be promptly relieved of their weight of snow, and it should also be seen to that all gutters should be kept free from snow and ice. This precaution will keep the leaders open, and prevent their bursting.