a piece of unbroken forest, less than half a mile from the Mammoth Cave Hotel, where all the requirements of the case seem to be met. This vast depression embraces many acres, and is so deep that, when standing on its edge, one can overlook the tops of the trees growing in the central portion. But it remains to be proved by further exploration whether there are any hidden channels communicating, directly or otherwise, with the remarkable group of domes and pits I have attempted to describe in this article.

AMERICAN INDUSTRIES.—No. 78.

INDUSTRIAL PROGRESS AS REPRESENTED AT THE FIFTIETH EXHIBITION OF THE AMERICAN INSTITUTE.

The popularity of the now constantly recurring fairs in different sections of the country, showing the advancement we are making in the arts and sciences, in mechanics, chemistry, and our multitudinous manufactures, seems to be in no way diminished by their frequency. They are, on the contrary, at once the index and exponent of the activity, enterprise, skill, and inventive genius which are so characteristic of American progress to-day, so that the public is in entire harmony with the spirit they represent, and heartily inclined for a ready appreciation of all which contributes to their interest.

The semi-centennial exhibition of the American Institute, now being held in this city, extends and rounds out what had heretofore been a long and most valuable record of the growth of our manufactures, and the contributions of American inventors and mechanics in furtherance of the march of improvement in all the arts and sciences. It is worthy of its predecessors in all that goes to make such an exhibition not only attractive to mere sightseers, but valuable as an educator, in the means it affords of bringing the public more heartily into sympathy with the spirit of modern scientific investigation, and rendering observers more appreciative of the high degree of excellence which is being reached in all industrial pursuits.

It would be impossible, within the limits of a single article, to make even the briefest allusion to all of the exhibits here shown that are deserving of attentive examination. In the machinery department every inch of space is occupied, and some of the engines working here are models of beauty and symmetry, doing their work so smoothly and noiselessly that one would hardly know they were running were it not from the motion of the belts and shafts and the machines operated. The most interesting exhibit in this department, and one which constantly attracts crowds of visitors, is that of the Brush electric light system, the operation of which, and its thorough efficiency, with a pretty accurate idea of the consumption of power, and the inconsiderable wear and tear, can be readily understood by any visitor with the least possible idea of machinery. Of the light itself it is scarcely necessary to speak, all parts of the exhibition being made as bright as though sunlight were streaming in at every window when all of the ninety-six lamps are burning, while half of them make the gas lights look as insignificant as the old-fashioned "tallow dips."

On the first page of this paper we present illustrations of some of the prominent exhibits at the fair. The display of the New York Belting and Packing Company, shown in the large view at the bottom of the page, bears a sign in large letters, with the legend

"RUBBER VS. LEATHER."

It is on the left, as the visitor proceeds from the main aisle of the exhibition building to the machinery annex, where it cannot fail to meet the eyes of all who use belting, and under the sign is inscribed the statement that it would require "one thousand ox hides" to furnish leather sufficient to manufacture the large belts shown. One could readily figure out this for himself by taking the surface measurement and allowing for only the portions of a hide usually taken by leather belt manufacturers, but here would come in the fact that many of the leather belt manufacturers use more of the inferior parts than others, and the further fact that, no two hides being exactly alike, and no one hide being of the same strength or substance in different portions, it would probably trouble the investigator with a mathematical turn of mind as much as it does the leather belt manufacturers themselves, to tell just what selections and measurements to make to obtain even strength and substance in any large belt.

All of this difficulty is avoided in the manufacture of rubber belts, which are sure to be homogeneous throughout, and never before has there been a better display of what it is possible to accomplish in the making of rubber belting than is afforded in this exhibit.

The New York Belting and Packing Company have for many years made this manufacture a leading feature of their business and introduced improvements of the highest value. The great strength of the rubber-coated and impregnated duck used in their belts insures them against any break from a tensile pull twice or three times as great as the best leather will stand; the "stretch" is also taken out completely, the belts being subjected, while under tension, to the action of a powerful hydraulic press, one of the largest of the kind in the world, the bed and platen of which are steam heated, so that the fibers, thus compressed between the hot plates, are set almost as firmly as the particles in a bar of steel; the edges of the belts are firm and smooth, there being practically no joints, and, by a long course of improvements in the composition, they have a hard and tough, almost metallic, surface, but still one of such a nature that these belts always hug the pulley more closely than leather belts.

The contest as to the relative value and efficiency of rubber against leather belts is an old one, but it is one which mechanics and millowners are always interested in, and only those who have seen and used rubber belts of the best quality are qualified to form a correct judgment, for, although there has been a great improvement in the manufacture within a few years, there are still made large quantities of rubber belts of a cheap and inferior quality. In connection with the belting shown in this exhibit are furnished testimonials from some of the prominent users, including many of the great elevator companies, who use the largest sized belts known. These show that in some instances the belts have been used twelve and fifteen years, "without costing a dollar for repair, and still in as good condition as when first set to work." This the company think quite as good a record as can be produced in favor of any leather belting made, notwithstanding the fact that a newspaper in the interest of leather dealers a few months ago quoted as follows from the pamphlet of a leather belt manufacturer: "Buying a rubber, gutta percha, or canvas belt is very much like buying a sickly horse at 33⅓ per cent less than a good healthy one would cost. If such a horse is well groomed, used carefully, left in the stable when sick—when the weather is hot, when cold, when stormy—he may live six months; with extreme care and good luck, one may be able to say that he owns a horse for twelve or eighteen months. Pay 33⅓ per cent more and buy a good healthy one, use him well and kindly, he is always at your service, and can be depended upon. After being in use twelve or fifteen years, he is still good. and, if sold, will bring 33⅓ per cent of his cost. A word to the wise is sufficient." This seems to be a case where the saying that "one story is good until another is told," is particularly in point, and, as the exhibits of both kinds of belting are excellent, those interested will do well to examine for themselves.

Of the other productions of the company, the various kinds of packing, hose, valves, car and wagon springs, mats, gas tubing, etc., make a most interesting display to all who desire to utilize vulcanized rubber fabrics for mechanical purposes. The knot of bicycle tires shown is likewise suggestive, not only of the rapid increase of the demand for these novel steeds, but also of many other uses to which this principle might be applied in rendering cars and other vehicles noiseless and increasing their traction.

The exhibit of Vulcanite Emery Wheels covers a full line of sizes, and embraces the leading grades for fine or coarse work. Only the genuine Wellington Mills emery is used in the manufacture of these wheels, and the company believe they have now attained very near perfection in their production. Every detail as to the best possible constituents for the composition which shall closely bind the emery, the degree of heat and time required for vulcanization, and the mechanical appliances best fitted for the necessary operations, were the subject of prolonged and costly experiments, and the success they have attained is best attested by the large demand for their wheels both at home and abroad. Only just enough rubber is used in their manufacture to bind the emery closely, but they are sufficiently strong to be run at a circumferential velocity of 5,000 to 7,000 feet per minute, and wear evenly, without glazing. Many as are the uses for which emery wheels have been employed in late years, there is hardly a week but develops some new work for them in our factories and machine shops, and a uniform as well as high quality has now become quite as important in this specialty as it is in any other part of the outfit of an artisan.

THE NEW PULSOMETER STEAM PUMP.

An illustration showing this exhibit at the Fair may be seen at the top of the page, to the left. The improvements made in this pump, since which it has been designated as the "new" pulsometer, have caused a widely extended demand, and are bringing to the company encomiums of the most valuable character from all parts of the country from users in almost every department of industry. The variety of pumps now in the market is almost endless, but the new pulsometer is this year on exhibition at all the leading fairs, in competition with those of every other description. At the Fair of the Massachusetts Charitable Mechanic Association, in Boston, where a leading feature is made of the working of pumps for a variety of fountains and large reservoirs, this pump was especially designated by the management to do a portion of the daily work that could not be dispensed with, on account of the comparatively small quantity of steam it required, where other pumps made too large a drain upon the boilers. With this efficiency it combines great strength and durability, it being so simple in construction as to be almost impossible for it to get out of order.

The quickness with which this pump may be set up and put in operation in any locality is, aside from the great amount of work it will do, one of its most valuable recommendations. It is connected at the top with a steam supply pipe, and at the bottom with the suction pipe, the discharge pipe leading from the discharge chamber. It works with a vacuum and with direct steam pressure in two chambers alternately, the operation being so nicely regulated by a well-fitting ball valve that the pumping proceeds steadily and almost noiselessly, like the regular beating of a pulse, from which the pump has its name and registered trademark. In working, the steam enters the chamber directly above the water, pressing upon and forcing it out through the discharge valve with a force proportionate to the steam pressure; when the water has been displaced by the steam, which follows it to the opening of the discharge chamber, the steam suddenly condenses, leaving a vacuum, which is at once filled from the suction pipe.

Among the striking testimonials which the company have this year received as to the efficiency of their pump was one which came from the Michigan Coal Company, who had a "cave-in" at their mine at Jackson, in that State. The shaft was 85 feet deep, and the water on four to five acres at the bottom was said to average five feet in depth; they testify that the water was lowered by a No. 9 pulsometer pump at the rate of twenty-three inches per hour. Numerous other testimonials are also furnished showing their efficiency for mining, railroad, and steamboat use, for all kinds of manufactures, for draining quarries and cellars, and for irrigation, and in Europe as well as in this country.

These pumps are made of brass or other metal for pumping liquids destructive to iron, with lead for acids, bronze for sugar works, and special composition or wood valves for other purposes. They are manufactured and sold by the Pulsometer Steam Pump Company, 83 John street, New York, Wm. F. Kidder being president of the company, G. F. Badger, secretary, and Geo. W. Laird, treasurer.

ASBESTOS PRODUCTS FOR ROOFING, BOILER AND PIPE COVERINGS, PACKING, PAINTS, ETC.

One of the first exhibits to attract the eye, at the right as you enter, is that of the H. W. Johns Manufacturing Company, which we illustrate in one of the views at the top of the page. Here are arranged a selection of their varied productions, including asbestos roofing, boiler coverings, lining felt, steam rope wick, and flat packing, millboard, gaskets, sheathings, cements, etc., with their liquid paints in a great variety of packages. The display is a more tasteful one than it would be supposed could be readily made from this homely yet highly utilitarian product, and cannot fail to interest millowners and steam users generally, as well as those who study economy and good service in either interior or exterior painting.

The variety of purposes for which asbestos has been made available within the comparatively few years since its valuable properties have become known, and practicable methods of working it perfected, would be somewhat remarkable, were it not simply a repetition of our experience in the uses so rapidly found for other natural products when skill and inventive genius first adapt them to meeting acknowledged wants of the public. This silk-like and really fine-fibered mineral has, through the agency of Mr. Johns himself, who first commenced its utilization in 1858, become a most invaluable agent for many mechanical purposes, besides meeting a multitude of wants of architects and builders in a way that at once increases the durability and lessens the cost in a great variety of structures. In its use for roofing, for instance, for which it was first adapted, its great economy over the expensive materials previously thought necessary, while it at the same time made a tight roof needing but little repair after years of wear, at once gave it an extensive demand. The appearance of these goods is familiar to all, it being furnished in rolls about forty inches wide, of any desired length, so as to make a light covering, and one very quickly put on; it consists of a manila lining, upon which is a layer of waterproof composition, then a strong canvas, another layer of waterproof composition, and a surface layer of asbestos coated felt. In connection with this roofing fabric, an asbestos roof coating is also manufactured for prolonging the service and keeping the roof in good order, also a white fireproof coating, which makes the roof air and water tight, forming an effective non-conductor for protection against fire from adjoining buildings.

In the paints, which form a conspicuous portion of the exhibit, besides the asbestos fireproof paints and coatings are a full line of fine linseed oil paints, in liquid form, the company designating their productions in this line, which have now become very extensive, with the well known trademark which distinguishes all their goods. These paints are ground and mixed differently from the processes usually followed, and are not intended to compete in price with cheap goods in this line, but are claimed to have superior durability, and therefore more economical to the consumer, than white lead and other paints in common use. For roof painting the company have a special preparation, which, either alone or in combination with their asbestos cement, they recommend for rough usage and in exposed situations, and also for the preservation and repair of old leaky tin and other roofs.

The styles of coverings for hot air and steam pipes, boilers, etc., preventing the radiation of heat and economizing fuel, are shown in great variety. The company have patents on many different combinations and ways of using asbestos for this purpose, but for pipe coverings they recommend their asbestos lining felt—a pure asbestos sheathing, to one side of which is attached "flocked" asbestos. This comes in sheets and rolls, and makes an insulating cushion or non-conducting lining, over which is placed a layer of hair felt and then one of non-porous fireproof sheathing. For boiler coverings, or where large surfaces are to be protected, the company recommend a special production called asbestos cement felting, partaking of the nature of a felt and a cement. There is sufficient strength and flexibility to the asbestos fiber to prevent the cracking of such a covering from the expansion and contraction of boilers due to varia-

ble degrees of heat, and its indestructible nature gives it great permanence.

Besides the above, there are numerous other productions in the exhibit into which asbestos enters more or less largely, and a great variety of specimens of the natural asbestos, but it is difficult to make the common run of visitors believe these goods are manufactured from such a natural product. A great deal of attention is given to a little illustration in the exhibit showing the indestructibility of asbestos by heat, an Argand gas jet being kept constantly burning, over which is fixed a handful of asbestos fiber, but the hot flame is seen to have no effect whatever on it, a result which surprises not a few of those who take these fine textured shreds to be of silk or some such fiber.

Mr. Johns is the inventor and patentee of the methods and processes by which all the products here exhibited are manufactured, being the originator in the application of asbestos for these modern uses, and for its combination and employment in every way heretofore found practicable. The New York office of the company is at No. 87 Maiden Lane, where illustrated catalogues, descriptive of their inventions, can be obtained, and their goods are sold by dealers in all the principal cities and towns in this country and abroad.

THE ALMOND COUPLING,

an interesting mechanical device, which attracts much attention, is shown in one of the small views. It furnishes a substitute for bevel gears and the quarter turn belt to allow of shafting to be run in any desired direction.

GAS STOVES

are shown in great variety at the exhibition, by manufacturers of stoves, meters, and heating apparatus generally, and our artist gives a sketch of one of the most noticeable of these, showing how to "put the kettle on," etc.

STEAM BOILER NOTES.

The London *Iron Trade Exchange* has the prospectus of a new steam boiler insurance company, incorporated under the name of the Scottish Boiler Insurance and Engine Inspection Company. The liability of shareholders is limited to the number of shares held by them. Their principal office is to be at Glasgow; their capital, £50,000, in 10,000 shares. Subscribers are required to pay five shillings per share on application, five on allotment, and ten shillings at the expiration of three months from the registration of the company. The other £4 are not to be called for, but remain a reserve fund for the security of insurers. It shows that steam boiler insurance is profitable, by quoting from the "Stock Exchange Year Book," the business of three other stock companies in England, none of which have ever been called on for their reserve, which is about the same percentage of the par value as that proposed by the new company, while their dividends have been from ten to twenty per cent per annum, with occasional bonuses varying from two to five shillings per share. It claims that there are in Scotland about 25,000 boilers, and only 9,000 to 11,000 of them insured. The *Trade Exchange* says:

"The business of the company is to insure boilers against explosion or collapse, and the periodical inspection of both engines and boilers, the testing of new boilers by hydraulic pressure, the superintendence of the erection of new engines, and the repairs of those in use, also to advise policyholders generally in matters relating to their engines and boilers. The system of boiler insurance and inspection inaugurated by a Manchester company, eight years since, has been eminently successful. It met the need of steam-power users of competent periodical inspection of their boilers without entailing great expense. By the system of boiler insurance the steam-power user is relieved of all anxiety as to the condition of his boilers; he could not effect a policy unless the plant was in safe working order, and, the policy once effected, the insurance company will, by careful and periodical inspection, see that the condition of the boilers is kept up. The destruction of life is rightly the most dreaded calamity in connection with a boiler explosion, and we feel satisfied that the Manchester Boiler Insurance Company, the Wolverhampton Company, and others have been the means of saving many lives by their insurance inspections. The Scottish Boiler Insurance and Engine Inspection Company is founded to insure and inspect boilers in Scotland, and, looking at the immense number of steam-power users north of the Tweed, there is certainly a wide and useful field for its business."

The boiler of a train on the Hastings and Dakota division on the M. and St. Paul Railway exploded, September 26, near Prior Lake, while running fifteen miles an hour. The engine was thrown 150 feet forward and off the track, two cars being derailed. Engineer Grove Bradbury was thrown a considerable distance and died soon after. The fireman and conductor Jones were slightly injured. No passengers were hurt, and they were sent to their destination on a special train.

Under the provisions of the new boiler inspection ordinance of Detroit, Mich., which has already gone into effect, all persons desiring a license must file an application with the inspector, William Wray, stating their experience and qualifications, and having the indorsement of at least two well-known citizens as to their temperate habits and good character. The inspector will then examine the applicants as to their qualifications, and report the names of such persons as he deems competent to the mayor, who will issue the license when the necessary bond is executed and the stipulated fees paid into the city treasury.

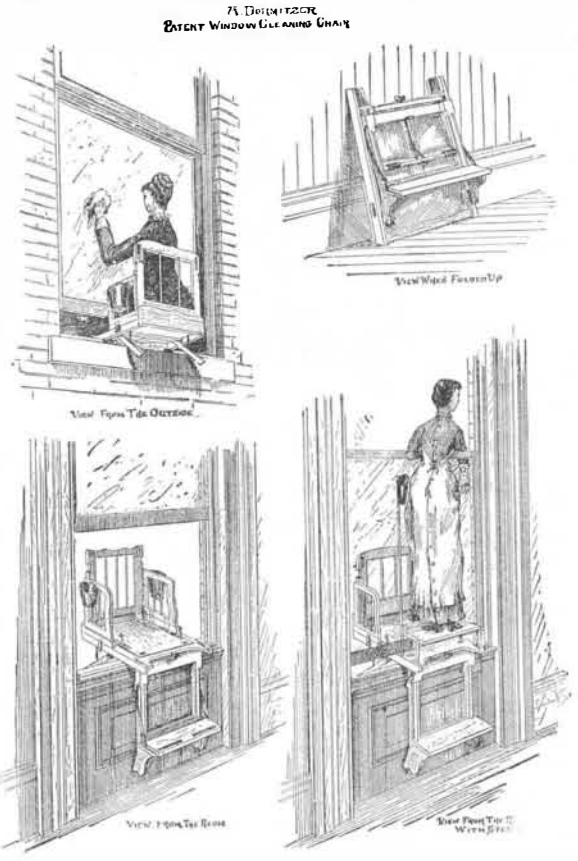
By the explosion of a boiler, late in September, near Uniontown, Pa., James McDonough was fatally scalded and four others injured. The cause was the use of sulphur water during the drought. This cause of boiler explosions has been before alleged, and was commented on in these notes under date of October 1. It is probable sulphur had less to do with the explosion than the announcement of its use seems to indicate.

The St. Louis *Age of Steel* says: "A Canadian mechanical engineer named Arnoldi has invented a device designed to give a partial security against boiler explosions. The invention consists of an electric adjustable attachment to the ordinary steam gauge now in use, to give an instant and continuous alarm, at any distance from the boilers or other pressure generators, of any excess of pressure over that at which the alarm has been set, and where there is more than one generator in operation, an ordinary 'tell-tale' can be attached to signify which generator is at fault. The invention possesses a great many valuable features, prominent among which may be noticed that it is extremely simple and inexpensive, and can be attached to existing arrangements at no expense beyond that of the alarm itself, and without in anyway affecting the present adjustment of the gauge."

This apparatus might be made very useful if placed beyond the reach of the boiler attendant, and connected by wire with the residence of the superintendent or owner of the boiler. It would, at night especially, tend to keep a watchman on the alert who might otherwise coal up the fires for a good rest, go to take a smoke or a nap when he should be attending to his duties. It would be an easy matter, however, for a rogue to disconnect the wire and thus defeat the object of the device.

IMPROVED WINDOW CHAIR.

The many accidents to life and limb of persons engaged in window cleaning or doing other work about the windows of our high dwellings calls for a safe support for persons



NEW WINDOW CHAIR.

doing such work. The patent window-cleaning chair, shown in the engraving, is designed to supply this want. It not only affords a safe and comfortable seat for females who are often obliged to risk their necks at this work, but it is also a strong and safe platform for men to stand on to paint, glaze, put up awnings or decorations, or do other work about windows. It holds cups for the necessary water and cloths to clean with. It is provided with supports for paint and brushes, and it will be found very desirable to those who wish to work quickly and safely, as well as a protection and safeguard to those who are timid and nervous while working in elevated places. The window chair is fastened and detached in less than a minute, and, in addition to the uses already mentioned, it will be found very agreeable to sit upon when it is desirable to obtain a breath of fresh outside air; sitting on it comfortably the cool breeze can be enjoyed without leaving the room. The construction of the chair is very simple, and so light that a child can carry it. It folds up like a book and stores away in a very small space. It will fit any ordinary sized window, and is provided with a step which permits of reaching the highest parts of the window, and the work of cleaning can be done without the aid of a step ladder. The window-cleaning chair can be seen at the Inventors' Institute, corner of Third and Fourth Avenues, Seventh and Eighth streets.

Oysters in New Orleans.

The coast of Louisiana abounds in oyster banks, and a considerable oyster trade has been developed at New Orleans, giving employment to about 200 luggers, each manned by from three to six men. The owner is usually captain, and receives two shares of the net proceeds of the sale of the oysters, one being claimed by the boat and one for himself. Every man on board then receives a share each in payment for his services, from which he has to pay his board or for his share of the expense incurred in the purchase of provisions. A trip usually consumes from four to seven days.

The oysters are taken by tonging. During the summer and early fall the supply is for the most part the small and watery "raccoon" or basin oysters, from Saline Bay, Grand Isle, and Barataria Bay. The price ranges from $1.25 to $3.00 a barrel. A better quality is received later from Bayou Cook. These oysters have been transplanted during the summer from Saline Bay and natural beds elsewhere, and are fatter and better flavored than the natives. Bayou Cook oysters fetch from $2.50 to $4.00 a barrel. Owing to the shortness of the orange crop this year a large number of fruit luggers will be transferred to the oyster traffic. The wholesale oyster houses in New Orleans give employment to upwards of 500 hands.

Gold in New York.

The Albany correspondent of the *World* finds that 757 persons have filed claims for 597 localities in the State of New York said to contain gold and silver. Some of these claims are explained by the fact that, to forestall other possible claimants, the owners of lands have filed claims for mineral veins, or suspected veins, without much regard for their intrinsic value. Most of the claimants, however, appear to believe that their discoveries are important; and it would also seem that, to a considerable extent, the claimants are not very well qualified to judge of the probable character and value of mineral deposits.

The correspondent cites a number of claims to illustrate the extraordinary ignorance of metallurgy shown by some of the would be miners. One locator claims the possession of a ledge yielding gold, silver, platinum, iron, tin, lead, and graphite—truly a curious, not to say wonderful, conglomeration. Another says that his claim is one-fourth pure silver—rich ore, as any Western man would tell him. And yet another locator states that his ledges, of which he has thirteen, contain gold as good as that placed upon Solomon's temple. He says, however, with exceeding *naveté*, "I have not found any yet."

The position of the claims shows four well defined gold fields. The first begins somewhat about Plattsburg, and runs in a southerly direction into the counties of Hamilton, Fulton, and Saratoga. It then divides into two branches, going west into Herkimer and east into Washington County. The second is south of this, in the neighborhood of Dutchess County. The third is still further, south in Westchester and Rockland counties. The fourth is in the western part of the State, in Erie and Allegany counties. From the fact that the Geological Survey has not yet made any examination of these alleged gold fields, it can only be said in a general way that quartz is known to exist in the neighborhoods where these gold and silver veins are said to be. It is therefore impossible, without examination, to say how much basis there is for the faith shown by the locators. In a few instances the notices filed in the office of the Secretary of State contain statements of assays made and work done, but these are not enough to found a judgment upon as to whether these gold fields will commercially pay. They simply indicate that the locators have, in some instances, proved their faith by their works. One of them records the discovery of a blind lead, or lead of which there were no surface indications of gold, while sinking a shaft on a silver vein. As the gold lead was discovered at a depth of fifty odd feet, the notice shows some considerable work done.

The Largest Elevator in the World.

The new elevator built by David Dows & Co., in Brooklyn, is said to be the largest in the country, and probably the largest in the world. It has 100 feet front upon Columbia street, and extends thence 1,200 feet to the river, 600 feet being occupied by the main building, which is of brick, and 600 feet by a frame extension, which is sheathed with tin. The frame building is 45 feet high, and has a tower in its center 100 feet high from the wharf level. The brick building is 85 feet high, and has an elevator tower in the northeast portion 120 feet high. Three towers rise from the center line of the main building, about 100 feet from each other. Each tower is 175 feet high. Solid brick walls divide the main building into nine apartments, closed to each other, except where there are openings for the belting to pass through. These walls form a bulwark against fire, as the holes can be closed by dropping a cast iron door over them, and if the fire should be so fierce as to cut off access to these doors they are so arranged that the ropes may be burned quickly, thus permitting them to drop of their own weight. An electric fire and burglar alarm is furnished for the building.

The machinery in the elevator can take grain at the rate of 8,000 bushels an hour from the barges or vessels at the pier. The grain is elevated, sifted and fanned, weighed, stored, put in bins, and then transferred to vessels at the pier. There is nearly a mile of wire cable used to transfer the steam power, and about five miles of belting, called conveyers, carry the grain up with railroad speed. These conveyers travel at the rate of 600 feet a minute, and carry to its destination 2⅓ bushels of grain a minute. No shoveling is necessary.