MODERN GRAIN ELEVATORS.

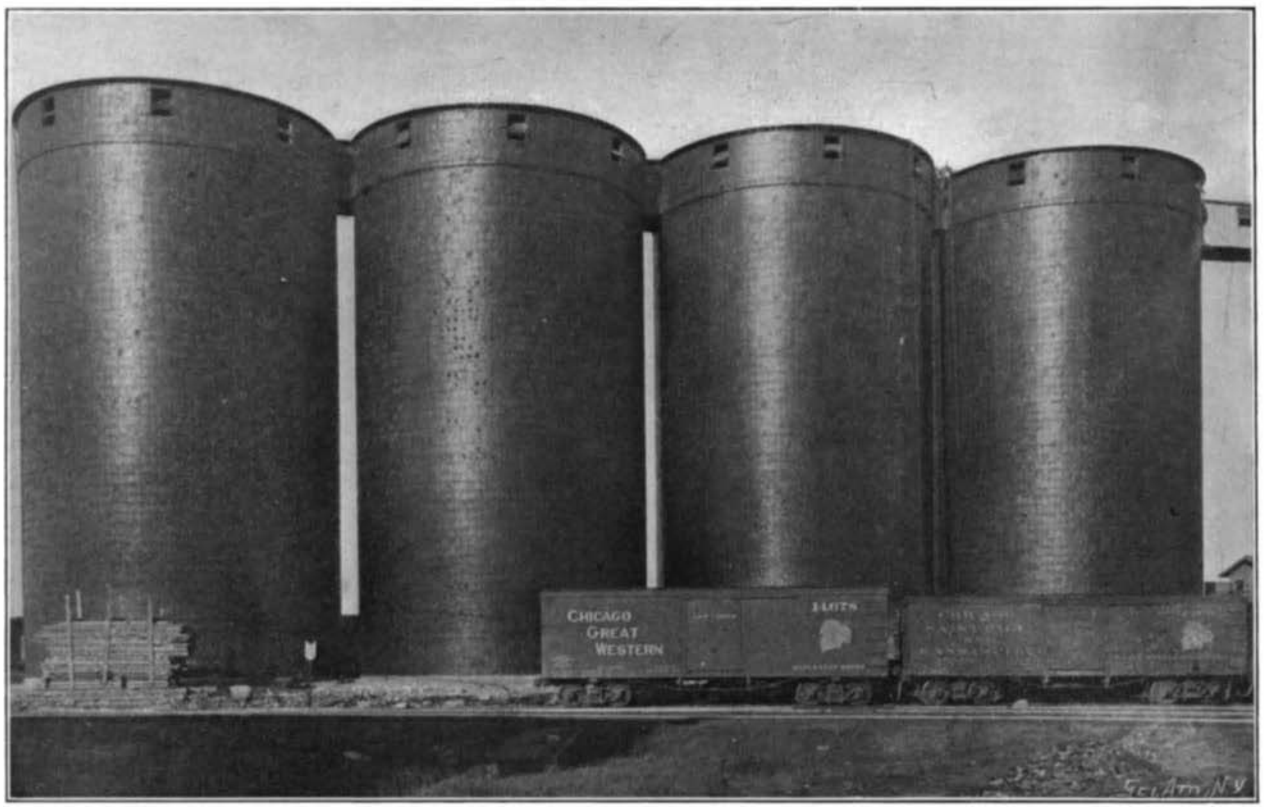
Of late years there have been some very radical changes made in the method of construction of the huge elevators which figure so largely in the storage and handling of grain. Not only have they increased enormously in capacity, but the form and materials of construction have been conformed to modern engineering methods.

We present illustrations of two of the latest elevators erected in Minneapolis, each of which represents an entirely different method of construction. One of the largest items of expense in connection with the elevator business is insurance, and the changes in construction, which we have referred to, have been brought about as much, and perhaps more, by the desire to lessen the insurance rates, as to provide elevators of vastly increased capacity.

FIREPROOF STEEL TANK ELEVATOR OF 1,200,000 BUSHELS CAPACITY.

Tanks 55 feet in Diameter by 80 feet in Height.

The larger of the two elevators shown is that of the Pioneer Steel Elevator Company. It was constructed by the Barnett & Record Company, and is located on the tracks of the Great Northern, the Sault, and the Northern Pacific Railroads. The total capacity of the plant is 1,200,000 bushels. At the center is seen the working house, which covers 70 x 84 feet of ground. This is a steel building, the floors of which are of composite steel and concrete construction. Double tracks run through the building on the ground floor, all of which floor is devoted to unloading and cleaning the grain. It has a capacity of 50 cars in and 50 cars out every day. The building contains 35 steel, hopper-bottom bins. On the ground floor are four large special cleaners, with a capacity of 25,000 bushels per day, two large wheat cleaners and one oat clipper. Above the bins, the frame of the building is of structural steel work, with a covering of corrugated iron. The total height of the working house is 145 feet. On either side is a line of five cylindrical steel tanks, each 55 feet in diameter by 80 feet in height, and capable of holding 100,000 bushels. The covered way which will be noticed, extending either way from the working house above the roof of the tanks, contains a belt conveyor, and a similar conveyor extends beneath the floor of the tanks. The power house contains a 250-horse power engine, and the rope-drive is used through the whole of the plant. The power house, working house, tanks, and, indeed, the whole plant, is considered to be absolutely fireproof.



FIREPROOF TILE TANK ELEVATOR OF 400,000 BUSHELS CAPACITY.

Tanks 50 feet in Diameter by 80 feet in Height.

Another form of fireproof construction has been used in the four-tank elevator which has recently been put up by the Barnett & Record Company, for the Great Eastern Elevator Company. It is constructed on what is known as the hollow-tile bin system, the walls of the tanks being constructed entirely of hollow tiles tied at intervals with steel rods. The method of construction is as follows: The tiles are set on edge in a tile base, which is tied by steel rods which run around the circumference of the tank. When a complete circle of the tiles has been placed, another tile base is put in position; and the operation is repeated until the full height of the bin is reached. On the inside of this wall is cemented a circle of white, vitrified tiling, placed with the openings or flues vertical, the result being that continuous air-shafts are formed through the wall from top to bottom. The four tanks are each 50 feet in diameter by 80 feet in height, the total capacity being 400,000 bushels. In a test made of this system at a time when the thermometer stood at 15 deg. above zero in the open, water and snow were applied to the interior of a section of the wall and allowed to freeze into a solid cake, while against the outer wall there was erected a furnace in which a fire was started and forced, until the pyrometer showed a temperature of 2,000 deg. It was not until the fire had been banked that the ice on the inside began to melt, and after the last of the fire had died away there was still some ice and snow remaining against the inner wall of the tank. In view of the results thus obtained, it is claimed that the contents of a tile tank are proof against injury by fire.

All from Coal-Tar.

As is well known, coal-tar, a by-product in the manufacture of ordinary coal-gas is a wonderfully complex substance, says The Spatula. No less than sixty different substances have been discovered in it, and more are being discovered every year.

One of the most interesting of these is benzine—a clear, mobile liquid discovered in gas oils by Michael Faraday in 1825. It is used in enormous quantities for the production of aniline, and also of a powerful perfume known as artificial oil of bitter almonds, or essence of mirbane. No less than 150 tons of this perfume are used in scenting soaps and other toilet requisites. Benzine has the useful property of dissolving fats, resins and india rubber, and is therefore of much value in the cleansing of goods by the dry cleaning method, and also in the forming of india rubber solution, so well known to lovers of the cycle and the football. In 1820 naphthalene was discovered in tar by Garden. This is a substance from which we derive some of our most beautiful colors, ranging from a buttercup yellow on the one hand to reds, pinks, greens, and scarlets. To entomologists this naphthalene is of interest, as it is now considered the best preservative for cases of moths, butterflies, insects, and other natural history specimens.

In 1832 anthracene was discovered by Dumas. It is now of immense importance, as it forms the base from which that beautiful and well known color Turkey red is now obtained. From time immemorial this valuable dye has been derived from the roots of the madder plant, the coloring principle of which is called alizarin. But in 1868 two German chemists, Graebe and Libermann, discovered a method of making artificial alizarin from the coal-tar product anthracene—a discovery which has completely revolutionized the dyeing and calico-printing industries. The excitement in the dyeing and coal-tar industries was immense. Anthracene, which formerly was considered a useless by-product, sold at a few shillings a ton and utilized as a cart grease, immediately rose in price and shortly after this discovery commanded something like $500 a ton. This artificial alizarin has now entirely superseded the natural product from the madder plant; and the cultivation of madder, which was once a great and flourishing industry, has now dwindled away, and in the course of a few years will probably be altogether extinct.

Phenol, or carbolic acid, discovered by Mitscherlich in 1834, being one of the most powerful antiseptics and disinfectants, purifies the atmosphere from noxious gases and destroys the infectious germs of disease. Its valuable antiseptic properties have been introduced into surgery with great success by the present Lord Lister, president of the Royal Society. From carbolic acid is obtained a valuable series of coloring matters, ranging from a beautiful yellow, i. e., picric acid, to reds, oranges, browns and many other colors.

The wonderful substance, aniline, is found only in small quantities in coal-tar, and its production on a sufficiently large scale for industrial purposes only became possible when Zinin, in 1842, showed it could be made from nitro-benzine, or the artificial oil of bitter almonds, already mentioned. All the aniline for the production of the innumerable beautiful colors is obtained from this derivative of benzine. In 1856 Dr. William H. Perkin, then a young man of 18, was engaged experimenting on aniline with a view of making an artificial quinine. Though his experiments in that direction were a failure, they were the means of his making the great discovery of the first aniline color, namely, mauve, and from these experiments has arisen a world-wide industry. In 1858, Prof. A. W. Hofmann discovered the magnificent color magenta, or aniline red, one of the most brilliant colors known to the dyer. Then came in quick succession greens, violets, blues and yellow coloring matters, all the hues of the rainbow, and at the present day the number and varieties of colors are bewildering.

We are indebted to coal-tar not only for beautiful colors, but also for some of our most valuable drugs. The valuable drug antipyrine, discovered in 1883 by Dr. Knorr, of Erlangen, is considered even better than quinine as an assuager of fevers, and is much cheaper in price. Another is thallium, discovered by Skraup, which has the special power of mitigating yellow fever, or the "yellow Jack," the dread of every colonist. Phenacetine is still another, possessing valuable antipyretic properties. Sulphonal, discovered by Prof. Baeyer, is a hypnotic. But perhaps the most remarkable substance obtained from tar is saccharine, 220 times sweeter than cane-sugar, useful for sweetening fruit preserves, jams, jellies, etc., where ordinary cane-sugar would mold and ferment in course of time. A most interesting and important property is that it does not nourish and fatten the body as cane-sugar does. Hence it is of value in certain troubles like diabetes, where it is often recommended by the physician for sweetening tea or coffee in place of cane-sugar.

Vanilin, now obtained from this tar, is a delicate flavoring essence resembling the true vanilla from the vanilla bean, and the cultivation of the plant in the Cordilleras and Mauritius has been greatly restricted from the introduction of this artificial vanilla. By mixing essence of mirbane with a certain proportion of this coal-tar vanilla, Lord Roscoe has prepared a delightful perfume known as white heliotrope, and many of the pleasant perfumes which play an important part in the toilet of every pretty maiden and courtly dame are extracted, by the magic of chemistry, from that black and ill-smelling substance, tar.

Glycin and Hydroquinone Developer.

After considerable experiment we have found the combined glycin and hydroquinone developer to be not only very effective and durable, but also one of the cleanest yet tried, which makes it particularly suitable for amateurs whose dark rooms have to be bath rooms, for it will not stain marble, towels, or the hands, should any of the developer come in contact with them.

It is also a very flexible developer, capable of being adjusted to most any kind of exposure, by simply adding, from time to time during development, a few drops at a time of the carbonate of potash solution, strength of one ounce dissolved in ten ounces of water, or instead, a solution which has previously been used and kept for a few days.

In one mixing it is possible to develop two dozen plates in succession, one as clear as the other. The developer is absolutely free from producing chemical fog, even during prolonged development.

Two solutions are prepared as follows:

No. 1.

Glycin (Hauff)	180 grains or	12 grammes.
Hydroquinone	60 grains or	4 grammes.
Carbonate of potash	180 grains or	12 grammes.
Sulphite of soda, crystals	690 grains or	45 grammes.
Water, hot or very warm	10½ oz. or	300 c. c.

In hot weather it is advisable to preserve it in small bottles, and place in lower part of icebox.

No. 2.

Carbonate of potash	1 oz.
Water (cold)	10 oz.

For use, take one part of Solution No. 1 and two parts of No. 2. Bromide of potassium is not necessary, as the negatives will be clear without it.

With a slight modification it is possible to produce with this developer very good negatives from plates which have been greatly overexposed by using the following solution:

No. 3.

Glycin	75 grains or	5 grammes.
Sulphite of soda, crystals	450 grains or	30 grammes.
Carbonate of potash	390 grains or	26 grammes.
Bromide of potash	15 grains or	1 gram.
Water, warm	20 ozs. or	625 c. c.

This solution can also be used repeatedly. For doubtful cases, as an overexposure, it will be a very sure way to use half and half. That is, mix of Solutions No. 1 and No. 2 only half the quantity needed, and add the other half from Solution No. 3.

For ordinary exposures with the developer showing a temperature of 70 deg. F., the image usually appears in about twenty seconds after the plate is covered with the developer, and development is generally completed in about four to five minutes. If at this time the plate is not sufficiently dense when viewed by transmitted light, it is only necessary to continue the development until the desired density is reached.

Electromotive Force Developed Between Magnetized and Unmagnetized Iron.

It has been found that if two iron electrodes are placed in acidulated water, one of these, upon being magnetized, becomes positive to the other, causing an electromotive force to be set up. The experiments of Dr. Hurmuzescu have shown that up to a magnetization of 7,000 units the curve which unites the electromotive force to the strength of the magnetic field developed in the iron has a form analogous to the curve of magnetization of iron, that is, the electromotive force, increasing at first with an increase of magnetization, afterward increases more slowly. M. René Paillot has extended these researches to very intense magnetic fields, and finds that the electromotive force seems to arrive at a limit beyond which it cannot be increased by further magnetizing the iron. In order to reach this limit a very intense magnetic field was needed, and this was obtained by using the semicircular electromagnet devised by Dubois, by which in the intrapolar space a magnetic field as high as 30,000 units is obtained. The experiment was carried out with electrodes in the form of iron wire carefully annealed; these were placed in the vertical branches of a tube bent up at each end, and filled with a dilute solution of acetic or oxalic acid. One of the branches of the tube, containing an electrode, is placed in the magnetic field between the poles, and as the lower straight portion is 12 inches long, the second branch with its electrode is entirely outside the field. The electromotive force, which was very small, was read by a Lippmann electro-capillary voltmeter, sensitive to the 10,000th part of a volt. The magnetic field was measured by the ballistic galvanometer. A number of observations were made, which agreed very closely, and the results are expressed in the following table:

Field strength H.	Electromotive force volts.	Field strength H.	Electromotive force volts.
804	0.0022	20210	0.0298
1698	.0040	23492	.0320
3106	.0074	24500	.0324
5000	.0110	26505	.0330
8712	.0171	27018	.0328
10504	.0191	28886	.0330
12193	.0210	29510	.0332
17043	.0272	30187	.0330

It will thus be seen that the electromotive force developed between magnetized and unmagnetized iron cannot be made to pass a certain limit. This limit, which is 0.0330 volt, is reached when the iron is magnetized to 25,000 units, and is not increased at a field-strength of 30,000 units, which is about as high as can well be obtained. The value of this limit depends somewhat upon the sample of iron and the strength of the acid, but does not vary greatly from the above.

STEAM HEAT WITH CONDENSING ENGINES.

BY ALTON D. ADAMS.

Industrial works have usually to choose between condensing engines and exhaust steam heat. If condensers are used, most of the heat of steam is rejected in their water, and the heating system must be supplied from the boilers. Should it be decided to use the exhaust steam in the radiating surface, at a little more than atmospheric pressure, the power and efficiency of the engine both suffer not only by the absence of a partial vacuum, but also from the positive back pressure. A compromise is sometimes adopted, by using condensers in the summer and the exhaust steam for heating purposes in the winter. This expedient makes a very material difference between the power of engines in warm and cold weather, also in the amount of coal consumed. The steam consumption per indicated horse power increases by 25 to 30 per cent during the cold season. Besides this loss of efficiency, the maximum power of an engine, working at one-quarter cut-off, would be reduced about 27 per cent by changing the exhaust connections from condenser to heating system, provided that five pounds back pressure is carried in the exhaust steam-pipes. Fortunately it is no longer necessary either to waste the heat of exhaust steam, when wanted for heating purposes, or to reduce by one-quarter the efficiency and outputs of engines during one half of each year. A vacuum of 26 inches may receive the engine exhaust for twelve months of the year, and the heat of this steam be applied for general warming to any extent desired. This desirable result is accomplished through the vacuum system of steam heating. The heating surface of this system, when operating with exhaust steam, does the work of a condenser; that is, it changes the steam to water and thus produces a partial vacuum. The latent heat of the steam, instead of heating condensing water, warms the air of spaces in which radiators are placed. The latent heat of steam in a partial vacuum is even greater per pound than at atmospheric pressure, and the heating power of the engine exhaust remains nearly constant, whatever the pressure, if rightly applied. To ensure the constant flow and condensation of steam throughout the heating system, air and water must be removed from the radiating surface as fast as they accumulate. This is effected by arrangements of suction pipes and valves that ensure the removal of air while they prevent its entry, and by suitable return pipes for the water.

As a result, the heating system when in use is constantly filled with steam of the pressure at which the vacuum is operated. The radiating surface for general warming will obviously have its greatest condensing action in the coldest weather. If this surface for general warming is the only one that may be used to maintain the vacuum, this vacuum must vary with the outside temperature. To avoid such variation of the vacuum against which the engines work, and to provide for condensation during hot weather, a condenser of one of the usual types should be provided, to operate in connection with the general heating system. If the exhaust is only sufficient for warming purposes in the coldest weather, the vacuum will be maintained by the condensation in the heating system. In warmer weather a part of the exhaust must be condensed by the use of water in the condenser, and when no general warming is required the regular type of condenser may do all of the cooling. This use of a heating system as a condenser for engines saves either the entire cost of fuel for general warming during the winter, or adds a material per cent to engine capacity and efficiency. The temperature of steam is only about 140 deg. F. in a vacuum of 24 inches. In other words, each pound of steam on condensation in a high vacuum gives up more heat units than at open air pressure, but the temperature at which this energy is liberated is greatly reduced. The vacuum heating system will warm as much space with a given weight of exhaust steam, as though operated at or slightly above atmospheric pressure, but a much larger amount of radiating surface must be employed for the purpose. Radiating surface is effective for warming purposes in proportion to its elevation in temperature above that of the surrounding air. The actual amount of heat given off per hour by a square foot of radiator surface per degree of temperature difference, varies with its construction, the movement of the air and other factors, but two heat units may be taken as an average figure. On this basis one square foot of radiation, supplied with steam at five pounds above atmospheric pressure, and with a temperature of 227 deg., delivers 314 heat units per hour to air at 70 deg. temperature. In contrast with this result, one square foot of radiator surface, heated by steam in a vacuum of 24 inches, has a temperature of 140 deg. and supplies only 140 heat units per hour to the surrounding air at 70 deg. under like conditions. To produce the same general heating effect the vacuum system must, therefore, contain two and one-quarter times the radiating surface that would be necessary for steam at five pounds pressure. Assuming that one square foot of radiating surface is in use 1,500 hours per year, at five pounds pressure, with surrounding air at 70 deg. F., it gives off 471,000 heat units during that period. If steam for this heat is taken directly from a boiler with an efficiency of 70 per cent, the coal consumed per square foot of heating surface must contain 672,888 heat units. At 13,500 heat units per pound, the coal per year for each square foot of radiation amounts to fifty pounds. With coal at $3 per ton, fifty pounds cost 7.5 cents. In order to use the vacuum system of heating with steam from condensing engines as above, one and one-quarter square feet of radiating surface must be added to each square foot necessary with steam at five pounds above air pressure, to give off an equal amount of heat. No increase is required for the vacuum system in the size of pipes to the heating surface, since the necessary weight of steam is not larger than at five pounds pressure. The cost of 1.25 square feet of rough heating surface, constructed with 1 or 1.25-inch pipe, as is common in industrial works, is 15 to 20 cents. Coal alone, during a single season was found to cost yearly 7.5 cents per square foot of heating surface in a system at five pounds pressure. When to this fuel outlay there is added the interest on investment for boilers to supply the heating system independent of the exhaust steam, the total will probably equal the cost of extra heating surface for the vacuum system in a single year. If the cost of decreased capacity and efficiency at the steam engine is figured for the case where condensing operation is abandoned, in order to supply exhaust to a heating system, this cost will be found to represent a very large annual interest on an outlay for the additional heating surface necessary in a vacuum system.

In summer as well as in winter the heat of exhaust steam from condensing engines may be put to useful work. Among the most commonly desired effects in summer are cooling and ice making. These processes are readily carried on by the heat of vacuum exhaust, on the absorption system of refrigeration. On this system, heat instead of mechanical power supplies most of the energy necessary to keep up the set of operations by which ammonia conveys heat from the substances cooled. This heat can be extracted from tubes in which the engine exhaust condenses, by the ammonia solution.

Where condensers are operated only during the summer, the exhaust is used for steam heating at a little above atmospheric pressure in the winter.

The law enacted at the last session of the Connecticut Legislature regarding the speed of automobiles went into effect August 1. The law limits the speed of all power vehicles to 12 miles an hour in cities and 15 miles on the country roads. If the driver of a horse holds up his hand to an approaching automobile the operator must stop immediately. A penalty of not over $200 is attached to the statute.