very high temperature which is required for their fusing and casting. By the addition of one five-thousandth part of phosphorus its point of fusion may be considerably lowered. As the phosphorus is not objectionable in nickelizing, the plates are generally made of metal containing phosphorus, and they are used to the best advantage in rather thin sheets, for, the larger the surface of the nickel plate, the less will be the strength of the current required; and when the pieces to be plated are not large, as will occur in the majority of cases, two or three Bunsen elements will be sufficient.

In addition to the above methods for nickel plating others have been proposed, which also give good results, but which require more expensive preparations than those previously mentioned; thus, for instance, the double salt of nickel potassium cyanide and solutions of nickel nitrate have been proposed. On account of the vapors which escape from the cyanide solutions, although only in small quantities, they are particularly objectionable, and therefore the employment of cyanide preparations, on account of their poisonous properties, should be avoided whenever it is possible to do so. The nickel nitrate gives a beautiful and durable coat of nickel. The solution is most effective when it is composed of 4 parts of crystallized nickel nitrate dissolved in 150 parts of water, to which 4 parts of ammonium hydrate are added, and then 50 parts of the acid sulphite of sodium are dissolved in the above solution.

The acid sodium sulphite is prepared by heating copper with sulphuric acid in a retort, the gas produced is passed through a small quantity of water, which will retain the copper which has been mechanically carried over, and then the gas (sulphurous acid) is dissolved in water until the liquid smells distinctly of burning sulphur. The solution which has thus been obtained is divided into two portions; one part is saturated with sodium carbonate as long as effervescence takes place, the other half of the acid is then added, and in this manner the bisulphite of sodium is produced. This must be employed as it is, because it is impossible to crystallize the salt by evaporation, for in so doing one half of the acid would escape and the mono-sulphite of sodium remain behind.

For nickel plating of the finest kind, such as is produced in American factories, a solution is prepared from the nickel nitrate and acid sodium sulphite. It sometimes happens that the nickel will strip or peel off from the metals on which it has been deposited. It is said that this objection can be overcome by placing the dried plated objects into a bath of oil and heating them up to 250°-270°.

According to Weston, a plating of great beauty and durability is obtained by mixing a solution composed of 5 parts nickel chloride and 2 parts boracic acid with one made up of 2 parts nickel sulphate and 1 part boracic acid, and then adding, while continually stirring, sodium hydrate (caustic soda) until the precipitate is redissolved.

For the nickelizing of iron or steel, it is best to first coat the objects to be plated with a thin film of copper, which is readily accomplished by dipping the material into a dilute solution of copper sulphate.—*Neueste Erfindungen und Erfahrungen*, viii., p. 411.

AMERICAN INDUSTRIES.—No. 77.

THE MANUFACTURE OF STEAM, WATER, AND OIL WELL FITTINGS.

It is only within comparatively recent years that it has ceased to be necessary for every builder of steam engines or boilers to make his own valves, pipe connections, and much other work of a similar character. The manufacture of these articles is now a separate industry. The expense formerly attending the production of these articles in connection with legitimate engine work, was necessarily very great, and no better evidence of this is needed than the success of the great manufactories of this class of goods, which are perfectly adapted to the purpose and provided with the most improved machinery and tools.

The views given on our title page illustrate the extensive establishment of the Jarecki Manufacturing Company, located at Erie, Pa., who have been very successful in building up and extending its trade.

The building was established about twenty years ago, without capital, and with apparatus consisting of only two hand-lathes of the crudest make, and a small furnace for melting brass. We cannot trace the developments of this concern from this small beginning to its present extensive proportions, although it would undoubtedly prove very interesting. The practical mechanical knowledge, industry, and sound business principles of the brothers, Henry and Charles Jarecki—the founders of the business—were elements that contributed most in placing this industry high among the manufacturing interests of the country.

Among the views on the first page is a sketch showing the general appearance of the buildings. They consist of several handsome structures having a frontage of 330 feet. The main building has an elevation of three stories above the basement, and covers an area 175x60 feet, and there is a wing attached to the rear which is 80x40 feet. To the right is the galvanizing shop, 70x40 feet, and the extension on the left is the malleable iron foundry, inclosing a space 80x150 feet. Attached to this at the rear and opening into it is the gray iron foundry, 60x100 feet. The annealing room, 50x80 feet, is back of this, and further to the right is the core shop, 50x160 feet. Situated between this and the main building is the rattler room, 40x100 feet. The buildings are all of brick, and substantial and strong in construction.

Entering the works at the west end, we pass through the office and into the main machine room (shown in the engraving), 175 feet long by 60 wide. All the available space is filled with lathes, planers, milling machines, and a great deal of other machinery employed for special work. Among the most perfect machines are those for tapping malleable iron fittings. They can be operated by an attendant having very little skill. For example, a T-fitting is placed in a chuck, which is then moved into position for the taps to enter the openings of the fitting. The machine is then put in motion, and while the taps are doing their work another Tee is put into a second chuck. As soon as the threading of the first fitting is accomplished the machine reverses itself, and when the taps have been carried back the proper distance it comes to a stop. The chuck holding the tapped fitting is then swung out, and the second one substituted. The method of procedure now is but a repetition of that already described, and the attendant has little else to do than to keep the chucks supplied with blank fittings.

In pipe fittings, such as Tees and elbows, it is very essential that the branches be at right angles to each other. To secure this result is next to impossible by the old method of tapping each opening separately. But the machines used in this establishment are so perfect that only correct work can be done on them.

The variety of sizes of the different patterns of malleable fittings made here is almost endless, and in their production due consideration is always given to the matter of adaptability and cost. Fittings for gas connections require only moderate strength, and are of a much lighter pattern than those designed for use as steam or water connections. For the convenience of the trade, manufacturers of this class of goods have a list, or chart, on which each fitting represented is supplemented with its number and size. Fittings sold by weight are numbered up to 671, and of these the greater portion are of two styles—the plain pattern for gas, and the beaded for steam or water. There are, besides, several other patterns of fittings, not sold by weight, which have no place on the chart.

With the larger and more massive machines, designed for tapping fittings varying in size up to three inches, the threading is effected with the same ease and smoothness of motion as in the case of the smallest machines. Fittings with openings varying in size present no difficulties, and a Tee with branches, each for a different size of pipe, is disposed of exactly as when the openings are all alike, and the tapping of one opening left-handed and the other right is just as easily accomplished.

Among machines designed for special work are those for making unions, flange unions, bushings, and a variety of other pipe connections, and the large upright machines for tapping gray iron fittings of the larger sizes up to six inches are especially noteworthy. Here the opening of the fitting is first reamed to the proper size, the reamer is then replaced with what is known as an expansion tap. The purpose of this tool is to do away with the necessity of running back the tap after the threading is completed. This is accomplished by shifting a cam arrangement whereby the cutters are drawn into the body of the tap, which is then removed without interfering at all with the motion of the machine, rendering stoppages unnecessary either for the removal or adjustment of reamer or tap. Other mechanism is employed for threading the still larger fittings, which include the size for 12 inch pipe connections. From a 12 inch Tee, which has a weight of about 300 pounds, down the range of sizes to the one-eighth inch elbows and Tees, of which eighteen or twenty weigh not more than one pound, the number of pieces of even the straight sizes of fittings is astonishing.

To one unfamiliar with the appliances in use in the production of petroleum in the Pennsylvania oil fields the purpose of many of the implements made in this establishment would be a matter of considerable conjecture. This company was one of the first to make a specialty of the manufacture of the class of goods used in the petroleum industry. They have, in fact, grown up with its development, and have never failed to keep pace with the requirements and constantly increasing demands of the oil producers. Most important in this line of goods are the oil well pumps. The pump chambers first in use were tubes of drawn brass, but in the matter of durability and cost they did not prove entirely satisfactory. The substitution of cast iron tubes for the purpose gave results most favorable in all respects, and now for many years this material has been used in their manufacture at this establishment.

The machinery for the production of these pumps consists of three upright boring machines, extending from the basement upward into the machine room, each with capacity for boring six pump chambers. Each machine is provided with six hollow spindles, into which are placed the solid cast iron cylinders, 5 feet long and 3 inches in diameter. By the action of the machine the spindles containing the cylinders are revolved, and the boring is done with drills which work upward to allow clearances for the chips. Afterwards a reamer is used to make the bore exact and true, and the now hollow cylinders are then transferred to a horizontal polishing machine, provided with plungers having at the ends fork-shaped attachments, secured to the tines of which are lead pieces, semi-cylindrical in form. As the pump chambers revolve at a high rate of speed, the plungers travel forward and back through the whole length of the bore, and by the aid of emery and oil the tubes are finished to a mathematical exactness in size and a most beautiful polish secured. These last mentioned machines, and many of the other specialties already referred to, were designed and built at this establishment.

A steam engine for oil well drilling is another production of this department. Its points of superiority are the perfection of its balance valve and the link-motion attachment, by means of which the engine can be instantly reversed, however high the rate of speed may be. For engines for deep well drilling this link motion is indispensable. Another useful and novel contrivance is the water packer, designed in part for use in deep wells to shut off water veins in the rock, but more particularly to confine the gas in the wells so that the accumulating pressure will force the oil up through the tubing and make a flowing well where otherwise the use of a pump would be necessary. A considerable portion of the machinery here is also employed in perfecting in its various parts the Jarecki adjustable pipe tongs, shown in the engraving. The superiority of these tongs has been well established. Each pair serves the purpose of six sizes of common tongs, and it takes but a moment to adjust them to any desired size. The steel bar or grip is reversible, the end that is made concave being intended for use in cases where injury to the surface is to be avoided. With the pointed end properly adjusted the tong is valuable as a wrench for square or other shaped nuts.

Another of the products of this department is a great variety of iron body globe and angle valves, safety and back-pressure valves, and gate valves, including all the sizes for which a demand exists, and varying in weight from ten pounds to one thousand pounds.

Equal in area to the main machine room, and in the story above it, is the brass finishing department, pleasantly situated and with windows on every side, affording ample light and ventilation. Here are made brass goods of almost every description, the supplies for steam purposes being most largely represented. With the relatively low prices prevalent for goods of this class they can be profitably manufactured only by the use of the most improved machinery and tools. Brass valves of any one size are here taken in work in lots of usually not less than one thousand pieces at a time, and many of the parts in the process of finishing pass through a succession of lathes before being completed. The brass valves and cocks include the sizes from one-eighth of an inch to four inch, and are of various patterns. For ordinary uses the bodies are left in the rough, just as they come from the moulds, except in such parts as can be easily finished. But of valves for steam purposes there is a great diversity of style and finish. The nickel-plated radiator valve, mounted with rose-wood wheels, and highly polished over its entire surface, is an example of perfection of workmanship and elegance of finish. The smaller lathes are kept busy on such brass work as air cocks and bibbs, cylinder and gauge cocks, and everything in that line used for either steam, gas, water, or oil.

Of materials made in this department for oil well purposes, the ball valves for use in the pump chambers already referred to are among the most important. Oil wells as at present drilled vary in depth from 1,700 to 2,000 feet, and experiments with valves of almost every description for pumping these wells have established the superiority of this ball valve, both in effectiveness and durability. The upper or plunger valve is among the views given. With the exception of the packing and seat, it is made entirely of brass, the ball being of very hard brass; the seat on which the ball rests is of hard steel, and is held in place by the valve crown or top, which clamps it to the body of the valve. For packing, cup-shaped leathers are used; they are arranged to admit of expansion under pressure to insure their fitting the pump chamber closely until worn too thin for further use.

The pressure to which the valves in actual use are subjected averages 1,000 pounds to the square inch. Under such conditions they are naturally rapidly worn out, but as all the like parts of the valves are made uniform, any worn or damaged part is easily replaced. The lower or standing valve differs from the plunger only in the arrangement of the packing, for which leather rings are used instead of cup-shaped leathers. The manufacture of these valves, under letters patent, has been carried on by this company for nearly twelve years, and during that time much progress has been made in perfecting machinery for the purpose. The finishing of the valve balls by the methods originally employed was an operation demanding a degree of skill in its accomplishment which few possessed, but with the mechanism now in use the process is a very simple one.

The deep well pumps include other sizes than those in use for oil wells. From the very small pump to be used in connection with one inch pipe they are made of sizes increasing regularly up to the monster pump for six inch pipe. The chambers for the larger sizes are heavy drawn brass tubes. These pumps are in use in all parts of the country, and many of the larger sizes are to be found in the Colorado mining districts, as well as at some of the principal breweries in New York city, where they are used in connection with artesian wells.

Another product of the brass department, although no brass is used in its production, is the Jarecki screw plate, shown in the engravings, the purpose of which is to thread and to cut off pipe. It is a tool capable of adjustment to different sizes of pipe. The cam plate and the face of the stock are stamped with corresponding figures, and to set the dies to any desired size the cam plate is moved until the figures corresponding to the size are in line, when the thumb nut is screwed down and the plate is ready for use. After a thread has been cut the stock can be instantly removed by shifting the cam plate so as to draw the dies back from the pipe. An important feature of this tool is that when a number of pieces of the same size of pipe are to be threaded there is a stud bolt which, after the dies have been properly set, can be adjusted to limit the throw of the cam plate to that size, and thus the trouble of resetting after each operation is avoided. The plates are also provided with an effective appliance for cutting off pipe. The working parts are all made after a uniform standard, and can easily be duplicated. Five sizes are made, which are numbered from 1 to 5, and their combined range includes the various sizes of pipe from one quarter inch to six inches.

The floor above the brass finishing department is occupied in part by the pattern and carpenter shops, which are provided with everything necessary to that branch, and most of the remaining space serves as a place for grinding castings, for which purpose a large number of emery wheels are in operation. The drill presses here, and the machines for punching, stamping, and shearing, are for the manufacture of boiler flue cleaners, for which cast steel is used to make the springs and scraper pieces, the stems or stocks being of malleable iron. This flue cleaner meets with a large sale, and has proved very efficient and satisfactory.

Going down from this floor on the elevator there are found the varied products of manufacture stored, ready to be put on the market. The store room is 175 x 60 feet, and is provided with numberless tiers of bins for the thousands of sizes of fittings of the various kinds, and with closed compartments in which the brass goods are kept to be free from dust and dirt.

The motive power for the works is furnished by a 125 horse power engine in a room adjoining the main building, and two large boilers supply the steam. The blacksmith shop has eight forges, a power hammer, and other necessary appointments. Adjoining this is the brass moulding shop, spacious and well ventilated, provided with five melting furnaces in which fifteen to twenty heats are made daily. The operation of melting and pouring is shown in the engraving.

The malleable iron foundry presents a scene of bustle and activity. Here bench or snap flask moulding is the process mainly in use, which differs from the ordinary moulding in not requiring a separate flask for each mould. The snap flasks are frames of wood, hinged at the corners, to admit of being removed from the completed moulds, which are then transferred to the foundry floor, and, if necessary, placed one upon the other to a height of three or four moulds. When piled up in this way the top moulds are poured first, and when the metal has had time to "set," they are removed, and those next below are ready to receive the melted metal. Only brass patterns are used here, which are arranged in forms technically called gates, each gate being made up of as many pieces as the size of the articles and dimensions of the flask will admit. The iron for this department is melted in an air furnace, and without artificial blast, a chimney 120 feet high affording the necessary draught. At one end of the furnace is the fire grate, so situated that the flames are carried over the iron to be melted. Thus all the different grades of iron in the furnace are fused at one time, and the melted metal need not be removed until it has become thoroughly mixed and is of a uniform temperature of the degree desired—conditions necessary for an iron suitable for heavy malleable castings. Charcoal iron is almost exclusively employed for malleable work. The castings, as they come from the moulds, have a white luster and are very brittle and hard. The view given of this department shows the men in the act of receiving the melted metal from the furnace and pouring it into the moulds. In an adjoining smaller room are made malleable castings from cupola melted iron. These are only the smaller and lighter pieces for which this process of melting has been found suitable.

In the spacious gray iron foundry near at hand are made the castings for the various sizes of iron for body valves and cocks, and also for the gray iron fittings, of which the multiplicity of sizes is almost as varied as in the case of the malleable iron fittings. For the lighter castings the breech-moulding process is used.

An interior view of the annealing room is given, showing the annealing furnaces, which occupy the entire length of the room on one side. As the castings come from the moulds they are first cleaned of sand by the tumbling process and are then brought to this department, where they are packed in iron pots, with alternate layers of iron scale. As fast as the pots are filled the tops are covered over with a layer of clay and then placed in the ovens. When an oven is full the opening is walled up with bricks, which are then plastered over with clay. Heat is now applied, gradually increasing in degree until the castings become red hot, in which condition they are kept for a length of time, varying from six to eight days, according as the castings are light or heavy. After the pots have been drawn out from the ovens and are sufficiently cooled the castings are dumped. In the process of extracting the carbon the castings have also been considerably changed in appearance, being now covered with beautifully colored scales of varying hues, from straw color to dark blue, which, if not quickly removed, would expose the castings to rapid oxidation.

Situated convenient to the foundries is the large core shop, where more than fifty men and boys are employed to supply the various moulding departments with cores, in quantities not less than twenty five thousand every day. The material, as prepared for making the cores, consists of a mixture of sand with flour, rosin, molasses, sour beer, or such other materials as may be required. The cores are formed in metal core boxes, or moulds, from which they are transferred to iron plates and carried to the ovens to be baked. Much of the work here requires a practiced and experienced hand for its accomplishment, while for the more ordinary forms the rapidity with which they can be made depends entirely on the dexterity of the operator.

In a building separate from the others and located near the iron foundries, are the tumblers or rattle barrels, ten in number, which receive the iron castings as they come from the moulds and the annealing pots. They are operated by means of a shaft which receives its motion from a special engine provided for the purpose.

On the premises is a natural gas well, drilled to a depth of 700 feet, which has been in operation for the last ten years. During the first year after its completion the supply of gas was sufficiently abundant to be used as fuel for generating steam, besides furnishing light for the different shops. But after that time the volume of gas diminished considerably, and from then on the yield, though steadily maintained, was no more than adequate to the need for lighting purposes.

The department last to be reached is the galvanizing shop. The variety of malleable and gray iron castings and fittings here in course of preparation to be galvanized includes a large amount of castings for clothes wringers and washing machines. Galvanizing is not a complex process, but the experience gained by long practice and careful observation is a necessary condition to perfect work. As the castings come from the acid baths they are immersed into melted zinc, and when thoroughly coated with that material are plunged into water and held there a moment, which gives them a frosted and silvery appearance. The operation of tinning is also performed here, which differs but little from the galvanizing process.

The extensive trade of this concern in the oil regions of Pennsylvania and the adjacent States has necessitated the establishing there of branch stores at the various business centers. At present the number of the stores is eight, but every new development of territory is closely followed in order that additional branches may be provided wherever the indications seem to favor such a step.

In the factory at Erie employment is given to about four hundred men. The uniform excellence in quality and workmanship of the diversified products of manufacture has secured a market for them in almost every State in the Union, and in the Dominion of Canada.

Characteristic Incidents of the Michigan Fire.

Fires had been burning in Sanilac, Huron, and Tuscola counties, but no one apprehended any danger. Farmers had set fire to slashings to clear the ground for fall wheat, but this happens every fall, and the fact that not a drop of water had fallen in from fifty to seventy days was not considered by those who saw the smoke clouds and replied that there was no danger. There was danger. Behind that pall of smoke was a greater enemy than an earthquake, and it had a tornado at its back and two hundred miles of forest in the front. From noon until two o'clock a strange terror held the people in its grip; then all of a sudden the heavens took fire, or so it seemed to hundreds. In some localities it came with the sound of thunder. In others it was preceded by a terrible roaring as if a tidal wave were sweeping over the country. Almost at the same minute the flames appeared in every spot over a district of country thirty miles broad by one hundred in length.

At Richmondville, ten miles above Sanilac, one hundred and fifty people had comfortable homes, stacks of hay and grain, teams, cows, pigs, sheep, and no fear of the fire which they knew was burning a mile away. At two o'clock the flames rushed out of the woods, leaped the fences, ran across the bare fields, and swallowed every house but two, and roasted alive a dozen people. It is hardly forty rods to the beach of the lake, and yet many people had no time to reach the water. Others reached it with clothing on fire and faces and hands blistered. The houses did not burn singly, but one billow of flame seized all at once and reduced them to nothing in ten minutes.

I saw many and many a spot where the billows of fire jumped a clean half mile out of the forest to clutch house or barn. The Thornton family were wiped out with the exception of a boy. Thornton had hitched up his team to drive the family to a place of safety, but when he saw that they were all surrounded by the flames he unhitched the horses in despair. Before they could be unharnessed they bolted in different directions, and the old man became so confused that he ran directly toward a big slashing, which was than a perfect mass of flame, and dropped and died with his head toward it.

Meantime the mother and children had taken refuge in the root house. This was a structure mostly sunk in the ground and the roof well covered with earth. Here they were all right for a time, but when the father failed to join them one of the sons went out to see what caused the delay. He was hardly out of the place before the door through which he had passed was in flames. In this emergency he ran to a dry creek, and by lying on his face and keeping his mouth to the ground he lived through it.

I talked with a woman who lived neighbor to the Thorntons, and who escaped by fleeing to a field of plowed ground. This was only a few rods from the root house, and she said it was fully an hour before the screams and shrieks and groans from the people inside grew quiet in death. One by one they were suffocated by heat and smoke, and their bodies presented a most horrible appearance. To one riding through the district it seems miraculous that a single soul escaped. The fire swept through the green trees the same as the dry. It ran through fields of corn at the rate of twenty miles an hour, and fields of clover were swept as bare as a floor. Dark and gloomy swamps, filled with pools of stagnant water, and the home for years of wildcats, bears, and snakes, were struck and shriveled and burned almost in a flash. Over the parched meadows the flames ran faster than a horse could galop. Horses did galop before it, but were overtaken and left roasting on the ground. It seemed as if every hope and avenue of escape were cut off, and yet hundreds of lives were spared. People spent ten to twenty hours in ditches and ponds, or in fields under wet blankets, having their hair singed, their limbs blistered, and their clothing burned off piece by piece.

In dozens of cases the first flames spared houses and barns, but after seeming to have passed on for miles, suddenly circled back and made a clean sweep of everything. Unless one rides over the burnt district he cannot believe the eccentricities of a forest fire. In the great swamp, between Sanilac and Sandusky, it burned everything to the roots for a mile in breadth. Then it left patches from ten feet to ten rods wide. Then again it struck in and burned lanes hardly twenty feet wide, leaving half a mile of fuel on either side. In the timber it seemed to strike the geeen trees harder than the dry ones. It was like a great serpent making its way across the country. It would run within three feet of a wheat stack, and then glide away to lick up a house. It would burn a stack and spare a barn ten feet off.

People felt the heat while the fire was yet miles away. It withered the leaves of trees standing two miles from the path of the fiery serpent. The very earth took fire in hundreds of places, and blazed up as if the fire were feasting on cordwood. The stoutest log buildings stood up only a few minutes. The fire seemed to catch them at every corner at once, and after a whirl and a roar nothing would be left. Seven miles off the beach, at Forester, sailors found the heat uncomfortable. Where some houses and barns were burned we could not find even a blackened stick. Every log, beam, and board was reduced to fine ashes.

Seven miles back from the lake at Forester a farmer gathered up fifteen persons in his wagon and started for the beach. The fire was close behind them as they started—so close that the dresses of some of the women and children were on fire from the sparks. It was seven miles of up hill and down, with corduroy, ruts, and roots, and the horses needed no whip to urge them into a mad run. As the wagon started the tire of a hind wheel rolled off. They could not stop for it, and yet, even on a good road the wheel would have crushed down in going twenty rods without it.

It is an actual fact that the horses pushed over that seven miles of rough road at a wild run, and the wheel stood firm. A delay of five minutes at any point of the road would have given fifteen more victims to the flames which followed on behind. I saw the wagon at the lake, and I saw the tire seven miles away on the roadside.

The people who sought the beach had still to endure much of the heat and all of the smoke. Wading up to their shoulders, they were safe from the flames, but sparks and cinders fell like a snow storm and the smoke was suffocating. The birds not caught in the woods were carried out to sea and drowned, and the waves have washed thousands of them ashore. Squirrels, rabbits, and such small animals stood no show at all, but deer and bear sought the beach and the company of human beings. In one case a man leaped from a bluff into the lake and found himself close behind a large bear. They remained in company under the bank nearly all night, and the bear seemed as humble as a dog. In another instance two of the animals came out of the forest and stood close to a well from which a farmer was drawing water to dash over his house, and they were with him for two hours before they deemed it prudent to jog along. Deer came out and sought the companionship of cattle and horses, and paid no attention to persons rushing past them.—*Detroit Free Press.*

Reed Bird Shooting in Delaware.

As they go southward in the fall, our favorite meadow singers, the bobolinks, take to the marshes and become reed birds, much sought after by sportsmen and pot hunters. At Chester, Delaware, the headquarters of the bird shooters of the State, there are forty professional "pushers." The shooting begins the first of September. The Philadelphia *Times* makes a brief estimate of the results of a month's shooting. At Chester, at the Lazaretto, and the two hundred club houses that line both banks of the Delaware from League Island to Marcus Hook, there will be at least nine hundred shooters daily. At the former two places 2,000 birds daily—taking the scores of those who push themselves and of the professional shooters—will be killed. Eight hundred gunners daily from the private club houses is but a fair count, and, giving them each a score of 10 birds daily, the total will be 10,000 birds killed every day in the month of September, an aggregate of 300,000 scored at the above places alone. This is but a meager approximation of the grand total, probably ranging over 1,000,000 when the marshes from Bombay Hook to Bordentown are included in the estimate."

The Non-Condensing vs. the Condensing Engine.

Experiments made with a Corliss condensing engine at a factory in Mulhouse, Germany, in 1878, and others made with a Corliss engine of the non-condensing type at the fifth Cincinnati Exhibition, in 1874, have been compared and ably discussed by Chief Engineer Isherwood, of the U. S. Navy, for the purpose of determining the boiler pressure at which the non-condensing becomes equal in economy to the condensing engine. His paper is given in the *Franklin Journal.* The well known opposition of Mr. Isherwood to high measures of expansion in the marine engine need not affect the mind of the reader, as Mr. Isherwood considers it abundantly proved that no economic gain results from carrying expansion beyond the measures easily obtainable in non-condensing engines, when using steam at 70 pounds boiler pressure and upward. No motive, therefore, can fairly be imputed to him for departing from his usual accuracy and thoroughness in searching for the truth. It is assumed that, since the back pressure in good examples of both types of engines may be taken as constant at about 3½ pounds per square inch for the condensing and 16 pounds for the non-condensing engine, and the feed water at 100° F. for the former and 200° F. for the latter, there is an initial steam pressure at which the two types will be equal in economic effect.

To offset the less back pressure and the greater measure of expansion in the condensing engine we have the saving of the power required to work the air pump and the higher temperature of the feed water in the non-condensing engine; but the question of the boiler pressure at which the two types become equal must be determined by experiment for each new set of conditions, principally because of the variation of cylinder condensation, which has been shown to be, in former experiments with this size of condensing engine, cylinder, and measure of expansion, as much as 29 per centum of all the steam evaporated in the boiler. This amount is varied by the relative size of the cylinder, the grade of expansion, which affects the extremes of the temperature of the steam during a double stroke of the piston, the character of the metal of the cylinder as a conductor of heat, and the piston speed, with any given initial pressure.

The engines which are compared are not of the same size, nor were they worked at the same piston speed.

The non-condensing engine had a cylinder 16$\frac{1}{16}$ inches diameter, and was worked at approximately 240 feet per minute piston speed. The condensing engine had a cylinder 24 inches diameter, and a piston speed of about 200 feet per minute. They were of the same length, 4 feet. The loss by cylinder condensation would have been something greater in the condensing cylinder if it had been as small as the other; and, on the other hand, the loss from this cause would have been greater in the non-condensing cylinder if its piston had moved at the slower rate, so that their differences in conditions may be considered as neutralizing each other as regards this loss. It is seldom, however, that conditions as nearly alike are subjects of careful tests for economic results. The horse power is measured by the number of Fahr. units of heat per horse power per hour. The cost of the heat, being a question of boiler efficiency, is ignored.

In his remarks after the discussion of the cost of the total horse power, the author says:

"The net horse power, representing the portion of the total horse power developed by the engine that was commercially useful, was obtained for the consumption of 31,707·0685 Fahrenheit units of heat per hour with the condensing engine, and of 32,091·6077 Fahrenheit units with the non-condensing engine; and if a very small allowance be made in favor of the latter for the greater economic vaporization in its boiler per pound of fuel, owing to the slower rate of combustion, the cost of the net horse power in both cases will be equal; showing that a non-condensing engine with an unjacketed cylinder of the experimental dimensions, using saturated steam of 70½ pounds boiler pressure per square inch above the atmosphere, with an expansion of nearly 4¾ times, gave the same commercial result—that is to say, the same net power for the same quantity of fuel per hour—as a condensing engine with a 2¼ times more capacious unjacketed cylinder using saturated steam of 66½ pounds boiler pressure per square inch above the atmosphere with an expansion of nearly 8 times. Hence, under the experimental conditions, no economy would result from the employment of a condenser and air pump, when the boiler pressure was not less than 70½ pounds per square inch above the atmosphere. If the engine works with a variable load, this must be taken for the lower limit of pressure—not the average pressure—giving equality of economic effect.

"The foregoing results are true for only the precise experimental conditions, and they will be modified by any of the causes which diminish cylinder condensation, as, for example, steam-jacketing the cylinders, superheating the steam, employing larger cylinders, etc.

"It is probable," the author says, "that with boiler pressure of from 95 to 100 pounds per square inch above the atmosphere the non-condensing engine would give the net power with fully as much economy of fuel as the condensing engine using the same steam pressure with the measure of expansion found to produce the greatest economy, even with steam-jacketing, steam-superheating, and cylinders of the largest dimensions in both cases."

This is certainly a matter of great importance in marine economy. The omission of the air pump and its appendages, and the reduction of the size of the engine, thereby relieving the vessel of a permanent deadweight, are worthy of our best efforts. The greater weight of boiler, if any, of the old marine types, rendered necessary by the higher steam pressure, may perhaps balance the mere weight of the omitted air pump itself, while the surface condenser is still needed to supply distilled water for the boiler. In making up an estimate of the economies, the room occupied and the weight carried, not only of the engine, condenser, and pumps, but also of the boilers, the fuel, and the water, in boilers and condensers are to be considered. It is known, however, that in using steam of high pressure, even in heavy condensing engines using high measures of expansion and great cylinder condensation, substantial progress in economy has been realized, and it may be that a still further advance may be made by improving the boiler and reducing the amount of water and fuel carried, as well as by omitting the air pump of the marine engine.

Effects of Lightning on Trees Near a Telegraph Wire.

Some instructive facts in this connection have been brought to light by M. Montigny, in recent examination of poplars bordering part of a road in Belgium between Rochefort and Dinant. The part in question is some 4,600 meters in length, and runs westward; it is level for some distance, then rises gradually to a height of 61 meters, through a wood, traverses a wooded plateau 200 meters in extent, then descends, still through wood, to a plain. A telegraph wire runs near the row of Virginia poplars on the north side, and it appears that, out of nearly 500 poplars forming this row, 81, or a sixth, have been struck by lightning. Hardly any have been struck in the other row. The trunks have been mostly struck on their south side and nearly opposite the wire. Comparing different portions of the road, it is found that in the horizontal part none of the (129) trees show injury from lightning, or at most only one (a doubtful case), but as the road rises through the wood the cases quickly multiply, and on the wooded plateau as many as 9 out of 14 trees, or 64 per cent, have been struck. On the slopes the proportion is 25 per cent.

M. Montigny distinguishes three kinds of injuries: (1) the bark torn and detached on a limited part of the trunk; (2) a furrow, straight or (rarely) spiral, made on the tree, from near the wire, down to the ground; and (3) a peculiar oval wound, with longer axis vertical, and lips colored light brown. Now, the furrows, which are probably due to the most violent discharges, are relatively most frequent on the plateau and on the western slope, which the storms usually reach first. M. Montigny is of opinion that the lightning, while provoked by the wire, does not strike this first, then the tree, but strikes the tree directly. His conception of the process is to the following effect: Suppose a thunder cloud charged with positive electricity. A long telegraph wire under it, though insulated, may acquire as great negative tension in the nearest part as if in direct communication with the ground, and the tension is greater the nearer to the cloud. While the inductive influence affects the wire most, near objects, such as trees, share in the influence according to their conducting power. The lightning, attracted in the direction of the wire, yet does not strike this, the insulating cups presenting an obstacle to its prompt and rapid escape. It finds a better conductor to earth in a neighboring poplar, wet with rain. From the facts indicated it results, that of two similar houses, one built on a plain, the other in a wood, and having a telegraph wire fixed to them, the latter is the more liable to injury by lightning, and the danger is greater if the wood inclosing the house be upon an eminence.

Positive Pictures on Gelatino-Chloride.

Two methods of preparing the chloride emulsion are considered—the first method (without ammonia) yielding pictures which may be bright brown or reddish toned, according to the developer selected; while the same emulsion, if digested for twenty-four hours, can be made to yield pictures having a fine violet-black tone.

The non-ammoniacal emulsion is prepared much after the manner generally adopted for the production of a gelatino-bromide emulsion, the soluble chloride being contained in a warm gelatinous solution, to which the silver nitrate is gradually added, while the mixture is kept in continual agitation. Twenty-five parts of gelatine are dissolved in 200 parts of distilled water, together with ·7 parts of sodium chloride, and 6·40 parts of ammonium chloride, it being convenient to allow the gelatine to swell for half an hour before applying heat. The gelatine being dissolved, and the solution at 50° C. (122° F.), a silver nitrate solution containing 15 parts of the salt in 200 parts of water is gradually added with agitation; and it should be noted that it is advisable to warm the silver solution to the same temperature as the gelatinous liquid.

The chloride is deposited, under these circumstances, in a very fine state of division, and the mixture is at once poured out to set, a beaker or drinking glass serving very well as a mould, and external cooling may be resorted to when it is desirable to work expeditiously. The gelatinized emulsion may now be cut into strips by means of a horn spatula or a strip of glass; but if a more perfect state of division is desired, it may be forced, nutmeg grating fashion, through a piece of wire netting. In either case the material is tied up in a piece of muslin, and is suspended in a vessel containing a considerable quantity of water, this being changed five or six times, unless a stream can be kept flowing through the vessel. The washing may occupy a period of six to twenty-four hours, according to the state of division to which the emulsion is reduced, the temperature, the frequency with which the water is changed, and other circumstances. This operation being satisfactorily finished, the emulsion is well drained, and is next melted at a temperature of about 50° C (= 122° F.)

As regards the filtration of the emulsion, fine linen, purified cotton wool, or a special paper which is sold for the purpose at the German photographic stock houses, may be used. The emulsion is now quite ready for use in coating either ordinary glass, opal glass, or paper; but if it is considered desirable to preserve the emulsion in the jelly form any great length of time, it is advisable to add 0·2 part of thymol or phenol to each 100 parts of emulsion, the preservative agent being previously dissolved in 5 to 10 parts of alcohol.

For the dark room, used for the preparation of the chloride emulsion, it is sufficient to provide the ordinary yellow or orange illumination required in working the wet collodion process.—*Photographic News.*

Influence of the Weight of the Air on the Flow of Springs.

In the geological section of the British Association, Mr. Baldwin Latham, M. Inst. C.E., read an interesting paper on the influence of barometric pressure on the discharge of water from springs. He stated that it was alleged by some of the long established millers on the chalk streams that they were able to foretell the appearance of rainfall from a sensible increase in the volume of water flowing down the stream before the period of rainfall. He had therefore undertaken a series of observations to investigate the phenomena, and he found, in setting up gauges on the Bourne flow in the Caterham Valley, near Croydon, in the spring of the present year, and selecting periods when there was no rain to vitiate the results, that whenever there was a rapid fall in the barometer there was a corresponding increase in the volume of water flowing, and with a rise of the barometer there was a diminution in the flow. The fluctuation in the flow of the Croydon Bourne due to barometric pressure had at one period exceeded half a million gallons per day.

The gaugings of deep wells also confirmed those observations; for where there was a large amount of water held by capillarity in the strata above the water line, at that period of the year when the wells became sensitive and the flow from the strata was sluggish, a fall in the barometer coincided with a rise in the water line, and under conditions of high barometric pressure the water line was lowered. Percolating gauges also gave similar evidence, for, after percolation had ceased and the filter was apparently dry, a rapid fall of the barometer occurring, a small quantity of water passed from the percolating gauges. The conclusion he arrived at was that the atmospheric pressure exercises a marked influence upon the escape of water from springs. The increase in the flow of the water was attributed to the expansion and escape of the gases held by the water under low barometric pressure, which caused the water to escape more freely, while with high barometric pressure there was a condensation of the gases, which led to a retardation in the flow.

MISCELLANEOUS INVENTIONS.

Mr. Bat Smith, of Spanish Camp, Texas, has patented an improved composition for preserving wood, consisting of eight parts of coal tar, one part of crude carbolic acid, and three-fourths part of crude pyroligneous acid, mixed and heated, but not permitted to boil. The wood to be treated is placed in a vessel filled with the compound, where it remains until saturated.

Mr. Frank B. Miller, of Enon, Clark County, O., has patented a novel design for a sleigh. A life-size, graceful deer is represented on each side of the sleigh, complete in every respect, from the hoofs to the horns. It is made of of one and one-half inch material, and is beautifully rounded and carved on the outer surface, the legs first being tapered to size of runner. The runners are single bent and are fastened together in front (in addition to a light rod) by two darts or arrows, neatly trimmed with gold and silver paint. The dash, back, and seat are so adjusted as not to mar the general features of the design.

Mr. Edward E. Bishop, of Littleton, N. H., has patented an improved incubator which is simple, economical, and efficient.

An improved chimney-flue brush has been patented by Mr. David C. Greenway, of Abingdon, Va. The object of this invention is the production of a brush by which chimney and other flues may be conveniently and thoroughly swept, and one which is adapted to flues of different sizes.

An improved cultivator has been patented by Mr. Moses S. E. Pittman, of Harlem, Mo. The object of this invention is to facilitate the cultivation of plants and the adjustment of the cultivators to the distance apart of the rows of plants.

Mr. William S. Plummer, of San Jose, Cal., has patented an apparatus for pressing potatoes and other vegetables, and at the same time laying the pressed material upon trays in a convenient form for drying.

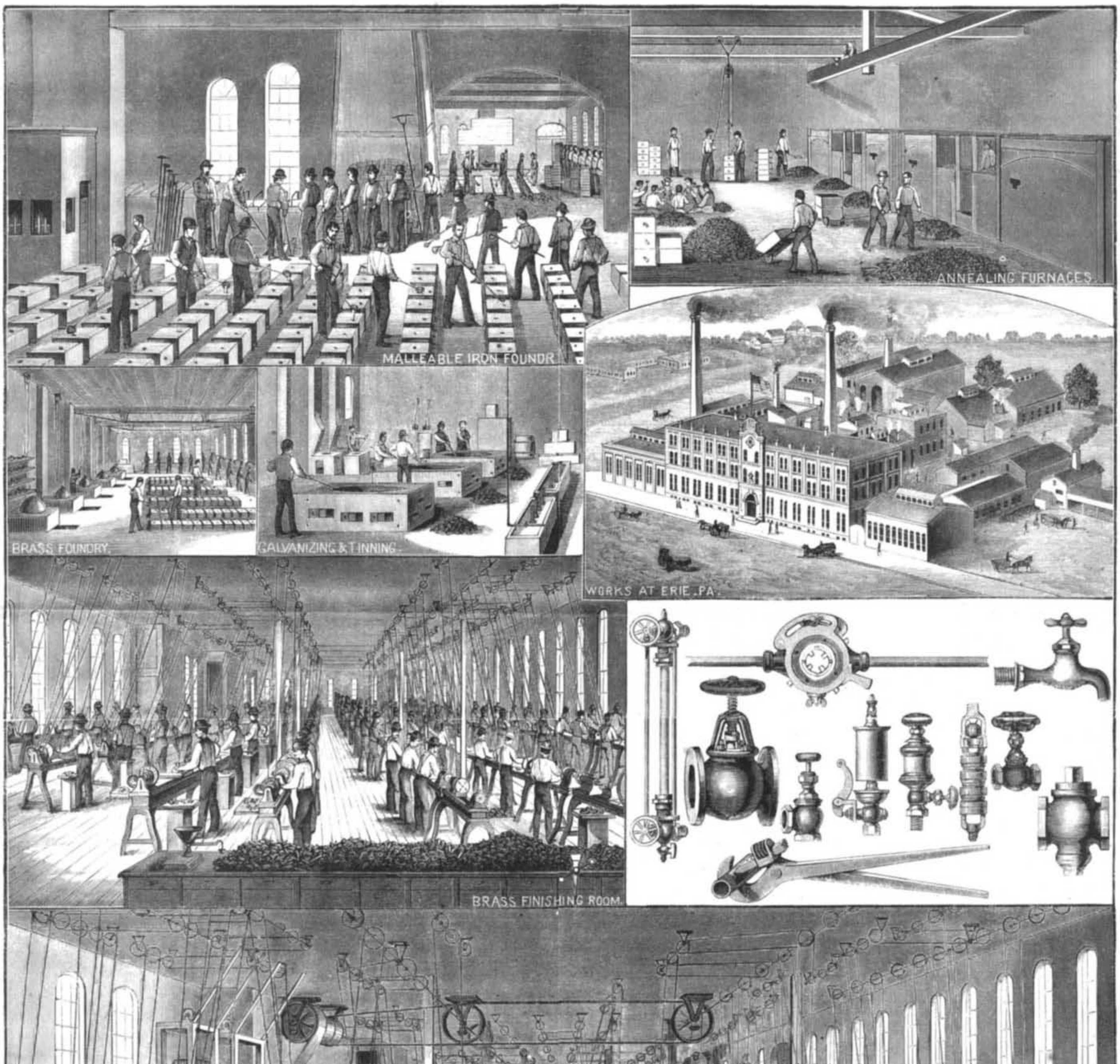
Messrs. John Greek and Francis M. Sellman, of Evansville, Ind., have patented an improved expanding rock drill for cutting a recess or cavity at the bottom of a drilled hole in a rock, or a coal or other mine, for the purpose of receiving the charge of powder or other explosive substance used in blasting. The invention consists in a novel combination with a drill rod or holder, of a pair of bits or drills, and the combination therewith of a cone of peculiar construction for expanding the bits or drills.

SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLV.—No. 17. [NEW SERIES.] | NEW YORK, OCTOBER 22, 1881. | [$3.20 per Annum. POSTAGE PREPAID.]



THE MANUFACTURE OF STEAM, WATER AND OIL-WELL FITTINGS.—THE JARECKI MANUFACTURING COMPANY ERIE PA.—[See page 264.]