Protection in England.

To a country without competitors free trade may be a good thing. But when foreign competition arises to cut the ground from under the home laborer or to prevent the establishment of new industries free trade does not appear to work so well. Of this truth England is now gaining bitter experience; and as a natural consequence the more intelligent manufacturers are taking ground against free trade in favor of protection of home industry. As an illustration of the manner in which closet theories go to the wall when faced by the stern necessities of actual business life, nothing better could be asked than this change of front by many English manufacturers. The practical working of free trade in their case is forcibly put by Mr. John Lister, of Bradford, the founder of the vast silk business of that town, based on his patented silk and velvet looms. Explaining to a correspondent of the *Times* his reasons for subscribing $10,000 to the Fair Trade League, he said:

"A few years ago my looms were idle, while London was flooded with German velvets. I was undersold. For two years I paid my workpeople out of capital. In that time, however, I had considerably reduced their number, and their wages were not nearly as much as they are now. At the time I speak of we were also beaten not only in velvets, but the Swiss spinners were even sending their yarns into Bradford. Supposing that I had been a weak capitalist, and this German confederation had overthrown me—what then? The free trade theory, that if one trade cannot supply laborers another can, would have been put to a severe test. Could the worsted trade of Bradford have employed my thousands of workpeople? No, sir. Could it do so then or now, or is there any other trade that could? None. In a recent lecture I gave this as an illustration to show how necessary it is to see how the laboring classes are to be employed before you allow one industry after another to be destroyed by foreign competition. Let us look a little further. I pay £1,000 a year poor rate. What if I had closed my mills and ceased to pay that or anything else? And, supposing, instead of paying £1,000 a week and more—£52,000 a year and more—out of my own pocket to support my workers, the poor rate had been charged with it, what then? I think some of the free trade ratepayers would have found out the practical effects of unrestricted foreign competition. What pen or tongue can say what my workpeople would have suffered? And for whose benefit? Certainly not for mine, for had I been a weak capitalist and gone to the wall, I should have been one of the chief sufferers. For whose good, then, would all the misery have been suffered? For the good of the foreign capitalist and the foreign workman, in order that luxury might be clothed at a farthing or so a yard less! That is free trade!

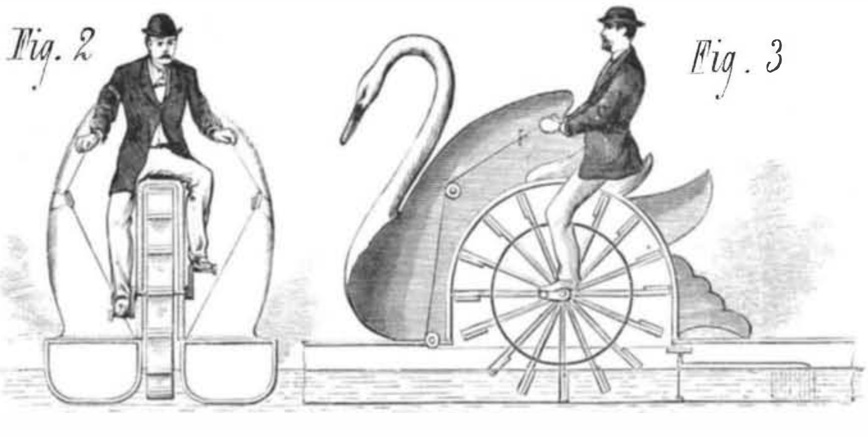
"In the early days of free trade there were no steamers, no means of rapid transit. We could not be inundated with foreign goods—even corn came in slowly. We were masters of the world in regard to manufactures. To-day we are not; to-day we have free trade in all its simplicity, and the result is disaster, the bankruptcy of the manufacturer, the ruin of the farmer, and the destruction of independent and profitable labor."

Nevada Monumental Granite.

The beautiful stone contributed by the State of Nevada to the Washington Monument has arrived in that city, and is described by the *Republican* as an object of great interest. It is a pure specimen of native granite, and is elaborately inscribed. The letters are of solid silver, and about as thick as a silver dollar, some six inches in height, and of proportionate width. They are so neatly fitted into the solid granite that the joint is almost invisible. Above the word "Nevada" is deeply cut in the granite the motto of the State, "All for Our Country," and below the date, 1881. The figures of the date are plated with gold. The granite composing it is the hardest ever seen. That part which is polished is almost blue in color, while the remainder presents a somewhat gray appearance. It is the most expensive stone contributed by any State so far.

The Survey of the Northwest.

Mention has been made in this paper of the projected scientific survey of the country tributary to the Northern Pacific Railway and the Oregon and Railway Navigation Company's lines, under Professor Raphael Pumpelly. The *Evening Post* announces that the work, which will be organized for a term of years, contemplates mapping the country "on a published scale of four miles to the inch," in order to show the geological structure, the distribution of minerals, of the different varieties of soils, of plants and animals, and the climatic conditions. For the thoroughness and high scientific quality of it the director's name is a guaranty, but he has also associated with him a number of trained men from the United States Geological Survey, including Mr. Wilson, the able topographer of the Fortieth Parallel Survey. The classification of the lands of the railroad companies according to their fertility and their mineral and timber resources will. of course, furnish a rational guide to the extension of branches, and will have a wholesome effect in turning immigration into remunerative channels. The bulletin which the survey contemplates publishing will thus be eagerly consulted. Meantime, the Signal Service will welcome the new meteorological stations to be established in the pre-eminently weather-breeding sections of the continent. In every way the country at large will profit by this nominally private enterprise, which anticipates the national exploration of the great northwest territory.



SECTIONAL VIEWS OF VELOCIPEDE BOAT.

VELOCIPEDE BOAT IN THE PUBLIC GARDEN, BOSTON.

We give engravings of a velocipede boat of novel design in daily use in the Public Garden, Boston, Mass. The boat is made after plans by Captain Thompson, and is not only an ornament to the lake, but is one of the easiest and most comfortable of small craft.

The boat is double, the two hulls being connected together by curved bars at the bow and stern. The paddlewheel plies between the hulls, and is located abaft the middle of the boat. It is worked after the manner of a velocipede wheel, and is covered by a metallic sheathing, which in turn is covered by a beautifully modeled swan in hammered copper.

The man working the wheel sits between the wings of the swan, and controls the rudder by tiller ropes extending upward over pulleys inside the swan, as show in Fig. 3. The hulls are of galvanized iron, and measure about twenty-five feet in length.

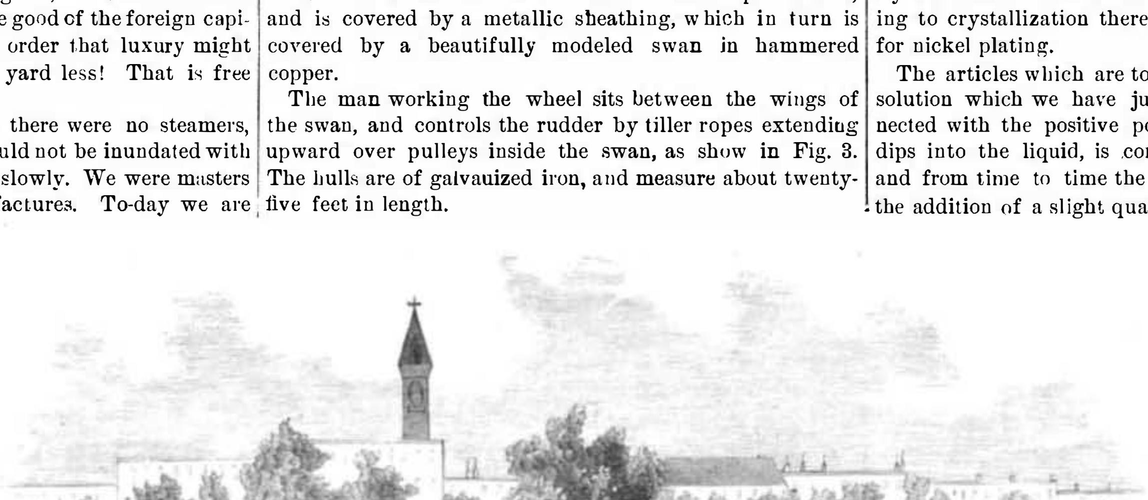


Fig. 1.—VELOCIPEDE BOAT IN THE PUBLIC GARDEN, BOSTON.

The boat does not attain a great speed, but it is free from rocking and tipping, and is a great favorite. A number of them are in use in Boston.

Another New Comet.

The Smithsonian Institution has received from the Astronomer Royal of Greenwich the announcement of the discovery, by Denning, on October 4, at 15 hours, of a bright comet in Leo, in 9 hours 22 minutes right ascension, 16° of north declination, with a daily motion of 30 minutes east.

This is the fifth new comet of this year, Encke's being an old acquaintance. All but comet A, 1881, are, we understand, still telescopically visible. Four of the six appeared in the constellation Auriga. It is quite unusual for so many of these erratic wanderers to be on view at once.

Some Practical Hints on Nickel Plating.

BY FR. HARTMANN.

Nickel plates and sheet nickel are now generally made by the manufacturers of nickel ware. These may be used in the production of a solution which is particularly well adapted for nickel plating. To this end the nickel is placed on a perforated board in a saturated solution of ammonium chloride (sal ammoniac), and the metal brought in connection with the positive pole of a strong battery. By the influence of the electric current the metal gradually becomes dissolved, and a double salt is formed (nickel ammonium chloride), which settles on the bottom of the vessel, while, at the same time, the metal is kept continually in contact with the ammonium chloride.

If the nickel has previously been weighed, the amount of the metal which has become dissolved can at any time be determined by weighing the as yet uncombined nickel. In order to nickelize with this solution, a plate of pure nickel is suspended in the fluid, and it is connected with the positive pole of the battery, while the metallic body which is to be coated, and which must, of course, be well cleaned, is connected, after it has been immersed, with the negative pole. The nickel is precipitated from the solution as a bright coat, whose thickness depends upon the length of time during which the current is acting upon it, and also upon the strength of the latter.

In order to operate directly with the nickel sulphate, it is necessary to have a salt entirely acid free, which may readily be prepared by adding a small quantity of sodium hydrate (caustic soda) to the solution of the commercial salt, after having first removed the copper in the manner which will presently be described. When the acid is neutralized, an apple-green precipitate of nickel hydrate is formed, which is boiled for some time and then filtered. The solution is now perfectly neutral.

To remove the copper from the nickel salt, the latter is first dissolved in water and acidulated by a few drops of sulphuric acid (commercial nickel sulphate is generally acid), then a current of hydrogen sulphide gas, which is prepared by pouring sulphuric acid over iron sulphide in a flask, is passed through the solution.

The copper and other metals which are likely to be present are thrown down in the form of a black precipitate. When the odor of the gas is distinctly recognized its passage is stopped, and the solution heated to expel the last traces of the hydrogen sulphide. It is then heated to boiling in a porcelain vessel with the addition of some metallic nickel By this means the free acid is neutralized, and on evaporating to crystallization there remains a salt sufficiently pure for nickel plating.

The articles which are to be plated are suspended in the solution which we have just described, and they are connected with the positive pole. A nickel plate, which also dips into the liquid, is connected with the negative pole; and from time to time the liberated acid is neutralized by the addition of a slight quantity of ammonium hydrate. It is better still, for practical results, to spread a layer of nickel oxide over the bottom of the vessel in which the nickelizing is being carried on. This will dissolve in the free acid, and the solution will therefore remain neutral and of uniform strength.

The nickel oxide is prepared by completely saturating a solution of nickel sulphate with sodium hydrate (caustic soda), washing the precipitate, and then drying it. The nickel oxide thus formed is a heavy powder of an apple-green color, and may be either spread over the bottom of the vessel, or else it can be placed in a linen bag and suspended in the liquid. If a solution of nickel sulphate, acidified with sulphuric acid, is poured into a saturated solution of ammonium sulphate, crystals will separate out, consisting of the double salt of nickel ammonium sulphate. The crystals are washed with cold water, dissolved in hot water, and then the solution is completely neutralized with ammonium hydrate. It is then allowed to stand for several days at a temperature of 20° to 25°, until no more crystals separate out. It is also of importance that the liquid be maintained at this temperature during the nickelizing, for otherwise the nickel will not adhere firmly to the metal.

During the operation of plating a sheet of nickel, connected with the positive pole of the battery, is suspended in the solution. According as the nickel becomes separated from the solution the sheet dissolves, and thus the solution maintains its original strength. Plates of absolutely pure nickel are at present quite expensive, in consequence of the 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