fixed so as not to yield to pressure, no explosion could occur—the mechanism of the pump not being strong enough to produce a bursting pressure.

This engine is the invention of Mr. Charles Tyson, of Philadelphia, and it is now being manufactured in handsome styles and introduced by the Tyson Engine Company, 1301 Buttonwood street, Philadelphia, Pa., to whom all letters should be addressed.

New Type of Torpedo Boats.

The torpedo boats used in the English Navy are of two kinds—those of the Lightning class measuring 84 feet in length and 100 feet 10 inches in beam; and those of the second-class, 60 feet long by 7 feet 6 inches broad. It has, however, been found from experience that first-class torpedo craft of the dimensions hitherto constructed are not sufficiently seaworthy to go out in any weather, and many governments are, in consequence, adopting a larger size. Messrs. Yarrow & Company, of Poplar, are at the present time engaged in building several of the new type of torpedo boats for various governments, including those of Russia and the Argentine Republic. They are 100 feet in length by 12½ beam, and are intended to be capable of going to sea under all conditions of weather unattended by other vessels. Their fuel carrying capacity will be sufficient for a run of 1,000 miles. They are also built much stronger and heavier than has been hitherto the practice, and are expected to realize a speed of 19 knots.

New Steam Frigate.—The Largest in the World.

The following from the *Mechanics' Magazine* of about forty years since affords an interesting comparison with the dimensions of ships of to-day: "The Admiralty have given instructions for the building and equipment of a new steam frigate, which is to surpass, in size and power, every thing of the kind yet afloat. She is to be of 650 horse power; to have engine room for 600 tons of fuel; complete stowage under hatches for 1,000 troops, with four months' stores and provisions, exclusive of a crew of about 450 men; and is to be armed with 20 guns of the heaviest caliber, besides carronades. The Cyclops, Gorgon, Geyser, and other war steamers now talked of as wonders for magnitude, will sink into insignificance as compared with this; the largest of them will be little more than half her size. For the sake of greater expedition she is to be made out of one of the large class frigates lately built (the Penelope, cut in two, with 55 feet in length added). The originator of this plan is John Edye, Esq., the able assistant surveyor of the navy (well known to all naval architects for his invaluable work on the "Equipment, Displacement, etc., of Ships and Vessels of War"), and she is to be completed at Chatham Dockyard, under his immediate superintendence and direction. The engines are to be on the Gorgon plan, and the commission for building them has been given to the inventors of that plan, Messrs. John and Samuel Seward. The vessel is expected to be fully completed and ready for sea before the close of the present year.

"The conduct of the government in this matter—conduct alike admirable for its vigor and promptitude—is, under the existing circumstances of the country, of a nature to give very general satisfaction. By nothing can such disasters as have lately befallen our arms in the East be so effectually repaired, or their recurrence more certainly prevented than by the fitting out of a few such leviathans of war as that which we have now described as being in progress. With half a dozen ships of this force at command, 6,000 men might within three weeks from the first receipt of the news from Afghanistan have been landed at Alexandria, marched in six days through Egypt (with leave of its Viceroy) to Cosseir, on the Red Sea, and transported thence in nine days more to Kurruckee, on the south coast of Scinde. With such a force there is hardly a corner of the world which British thunder could not reach in early time enough to uphold, against all opposition, British influence when linked in honorable alliance with the interests of human civilization and happiness (may we never know any other!). It is, moreover, a simple mechanical fact, which admits of no denial, that Great Britain can show forth a power in this way (thanks to her mechanics! thanks to her workshops! thanks to her practical science!) which no other country in the world can at all approach, far less rival. Every year, for the last half dozen, has witnessed some paper decree for the formation of a French steam navy, with engines of 300, 400, and 500 horse power, but where are they? It is notorious that all France has never yet been able to produce an engine, good for anything, of more than 200 horse power. Were such an order, as has been just given by our Admiralty for a pair of 325 horse power each, to be furnished in nine months, to be given by the French Government to French manufacturers it could not be executed (if at all) in as many years."

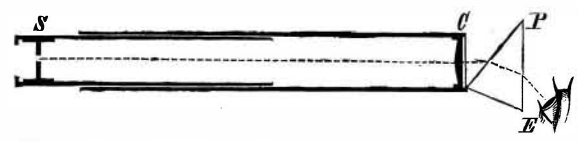
ITALIAN PRIZES FOR AMERICAN VINES.—The London *Times* reports that the Italian Government has offered three prizes, amounting to $1,800, for vines raised from grafts of American varieties of grapevines capable of resisting phylloxera.

MILLER OIL CAN PATENT.—The House Committee on Patents agreed, Feb. 24, to report favorably to the House the bill extending the patent of Henry Miller on oil cans.

CHEAP SPECTROSCOPE.

The Fraunhofer lines in the solar spectrum, and some of the bright-line spectra, can be seen by the aid of the following simple arrangemen

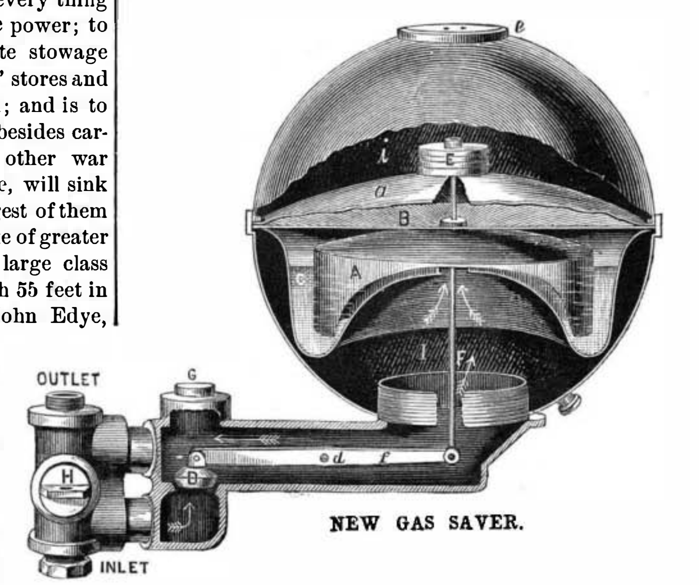
Make the slit in a piece of thin (very thin) sheet copper,



by laying it on a smooth surface—a planed deal board, say—and cutting the slit with the aid of an old sharp knife and a hammer. Get a piece of tubing with a shorter piece sliding in it to carry the slit, S, in the figure. The collimating lens, C, may be about 8 inches focus, and is placed its focal length away from the slit. A prism, such as may be bought for 50 or 75 cents at the optician's, held at P, will show a spectrum to the eye at E.

NEW GAS SAVER.

One of the difficulties connected with gas illumination is that the pressure in the mains varies considerably in different parts of a town or city, and at different hours of the day and night, consequently a system of lighting, adapted for a part of a town situated in a low level, will show inferior results in a more elevated situation. A rise of ten feet gives, roughly, a tenth of an inch of increase of pressure, as indicated by the manometer, so that it may easily happen that in the same town or city the pressure in one place may be one inch, while in another it may be two and a half inches. Again, the pressure of the gas, as sent out from the gas works, varies from time to time, in accordance with the quantity consumed, and as public works, shops, etc., are suddenly lit up or extinguished at certain hours, private consumers are annoyed, in the one case by falling off in the amount of light, and in the other by a flaring flame and hissing sound; and, besides this, for every increase of pressure there is an increase of consumption without an equivalent increase of light.



NEW GAS SAVER.

The annexed engraving represents an instrument designed to obviate these difficulties. In this device a diaphragm is used, but it is not subject to deterioration, as in other forms of regulator, as it is protected from contact with the gas by a strong metallic shield; between the diaphragm and the gas there is at all times pure atmospheric air. This is an improved and most important feature, which, the inventor informs us, is entirely new in this class of inventions. The valve is perfectly balanced, and operates so that no matter how great or variable the pressure may be, it cannot operate on the surface of the valve. This arrangement obviates the necessity of putting on and taking off weights. The main mechanism is contained in a spherical copper case, connected to a hollow arm or casting at the bottom. At the end of the casting there is an inlet and an outlet, arranged for connecting a by-pass cock, H. The edges of a float, A, dip into the well or trap, C. This well or trap is primed with glycerine, a fluid that is neither volatile nor affected by heat or any degree of cold, and will never require changing. It prevents the gas from coming in contact with the diaphragm, and insures a perpetual seal around the cup, A. Across the center of the case there is a diaphragm, B, which prevents the glycerine from being displaced by the pressure of the gas, also prevents spilling of glycerine by accident. This peculiar formation of the glycerine holder or trap renders the moderator transportable to any distance and in any position.

When the by-pass cock is closed the gas will pass over the valve, D, and fill chamber, I, and the space under cup, A, as shown by the arrows. The cup, A, diaphragm B, and rod, F, are equally balanced by the valve, D, on the fulcrum, *d*, and lever, *f*. The pressure of the gas will raise the cup, A, and in doing so the rod, F, will be lifted, when the lever, *f*, will throw the valve, D, down on its seat.

To adjust the valve to the proper rate of pressure for gas, small weights are placed at E. When one burner is opened the cup, A, drops and opens the valve and lets out of the gas meter just enough gas for that one, and at a rate of pressure from which all the light is derived from gas, and so on for every burner that is opened. If one burner is closed the cup, A, rises, causing the valve, D, to close also, and so on for every burner that is closed.

If the pressure from the gas works increases while using one or more burners, the valve, D, drops and retards the flow of gas. If the pressure goes down at the works, the valve, D, opens and lets out more gas. This device is, in fact, a self-acting valve on the meter or mains, and the inventor claims that no amount of personal watching can equal this simple device.

By opening the by-pass cock the gas will go direct to the burners without being operated upon by the moderator.

The inventor of this instrument is Mr. J. S. de Palos, of Room 34, No. 206 Broadway, New York.

The Leyden Jar.

Mr. E. H. Gordon delivered lately a lecture at the London Institution on "The Leyden Jar." The lecturer proposed to tell his hearers something about this important portion of electrical apparatus, that they might see whether the study of its phenomena might not shed some welcome light on the way in which electrical forces acted in the great field of nature. The invention was arrived at accidentally, in 1746, by a Leyden University student, named Cuneus, who was trying to electrify water, and in the course of the experiment, having first unconsciously made himself part and parcel of a reservoir full of stored-up electricity, afterwards converted his body no less innocently into a discharging rod. The shock he got was so smart as to force from him the exclamation that not for the whole kingdom of France would he expose himself to such another. Subsequent investigation led to some clearing up of the phenomena and to the devising of safe arrangements for slowly filling a glass vessel with the electric fluid and emptying it in an instant at will. The common Leyden jar was described and its action shown and elucidated. Experiments followed with a greatly improved apparatus, which was no sooner filled with electricity than the fluid instantly overflowed like water, but in intensely vivid and loudly crackling sparks. Yet, as was experimentally demonstrated, there was no continuous stream, but only an aggregate of so many jarfuls. Moreover, the electric fluid, unlike water, could be made to fill the jar by pouring it outside. It was thus clear that the electricity acted in some way through the glass, which used to be regarded as an absolute non-conductor interposed between the two conducting surfaces, the outside and inside coatings of tin foil. The question in this, as in other instances, was one of more or less resistance to the electric strain, which many experiments proved to be very analogous to mechanical force. It was shown that in proportion as glass was heated the resistance was lessened, and other experiments illustrated the perforation of even very thick plate glass by concentrating upon one point the strain of the electric spark. Of course, the thinner the glass the more easily was it pierced. In like manner, the more rarefied the stratum of atmospheric air, the more readily did it transmit electric discharges. The experiment of the aurora tube was one of those performed in illustration of these statements.

An important phenomenon in connection with the Leyden jar was the so-called "residual charge," which a faint spark showed to have collected a few minutes after the discharging rod had done its part in emptying the reservoir. This was compared with the residual recoil of an elastic body which had been bent, but which needed a second effort in resuming its original position. What was more, Professor Ayrton's experiments on this problem, which were not only unpublished as yet, but had not even been laid before the Royal Society, proved that the phenomena in the two cases were the same in degree as well as in kind. The researches of Dr. J. Hopkinson, F.R.S., authorized the conclusion that the electric strain which spanned the cosmical spaces, as in the instance of the magnetic storms caused by sunspots and disturbing our electrometers, was as mechanical in its action as that transmitted through short distances, and which was quite under our own control. Lastly, the late Professor Clerk-Maxwell had mathematically demonstrated that the ether which fills all space was the identical medium which transmits electrical forces from the sun to the earth.

Submarine Communication with Australia.

About two years ago the Australian colonies expressed a desire for the duplication of the telegraph cable then existing between India and Australia. The Eastern Extension Telegraph Company (to whom the cable belonged) therefore sent out its managing director, Colonel Glover, R.E., who negotiated with the various colonies on the spot, and agreed, on behalf of the company, to lay a second cable in consideration of the payment by the colonies of a subsidy of £32,400 per annum for a period of 20 years. This agreement was ratified and signed in London on the 6th of May last, and it was then stipulated that the work should be completed within a period of eight months.

Subsequently, after a great portion of the cable had been manufactured, the Imperial Government became desirous of establishing telegraphic communication with its South African colonies, and entered into negotiations with Mr. Pender, who, with his usual energy, undertook to carry out their wishes. As it was of great importance that the utmost expedition should be used, application was made to the Australian colonies to allow this portion of their cable to be diverted for this purpose. This was agreed to, and the consequence was that the whole of the telegraph cable between Aden and Natal, a distance of 3,838 miles, was completed in December last, thus bringing South Africa into telegraphic communication with England. When acceding to this diversion the Australian Governments liberally allowed an extension of two months to the time originally fixed for the completion of their duplicate cable, thus bringing it down to the end of February next.

We have now to announce that the duplicate Australian cable has been completed, and is open for traffic, thus anticipating the contract time by more than a month. The new cable takes a somewhat different route to the original. The old cable from Singapore landed at Batavia, and the messages were sent over the Dutch Government lines to Banjoewangie, at the furthest extremity of Java, where the Australian section of the cable commences. By the new arrangement the Singapore section is taken direct to Banjoewangie, thereby avoiding the Java land lines, which will effect a great saving of time and tend to greater accuracy, as the messages will pass entirely through English hands.

It will, therefore, be seen that during the last ten months the above mentioned cables, aggregating about 6,400 miles in length, have been manufactured and laid. This work has been carried out without a single drawback or difficulty arising, the credit of which is due to the perfect organization and resources of the Telegraph Construction Company, who have manufactured and laid the whole of these cables within this limited period.—*London Times.*

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[*Continued from first page.*]

use; (3) it was not subjected to sufficient strain to impair its accuracy, and (4) the pressure was borne by the end of the pitman, and not by the pin. These improvements, with a solid frame for the press, of which the bearings for the slide became a part, so materially enlarged the field in which the power press might be practically employed, that the demand for presses rapidly increased as new uses for such machines were continually found.

The manufacture of power drop hammers is also an important branch of business carried on by the Stiles & Parker Company, and the improvements which have been made in drop hammers have been almost contemporaneous with those effected in the power press. At first the drop hammer was simply a weight with a rope therefrom running over a single pulley. An early patent provided for attaching the hammer by a strap to a crank, in which were pin holes by which the height of the rise of the hammer was regulated. This was succeeded in 1863 by the friction roll drop hammer, in which the hammer was made to fall, at the will of the operator, from any height, or automatically from a given height, so as to give either a light or heavy blow as desired. Mr. Stiles has since improved upon this machine, so that the automatic and voluntary adjustment are now combined, and a uniform, an occasionally varied, or a constantly varied blow may be given at the will of the operator, and the machine is as perfectly under the control of the workman as is the hammer in the hands of the blacksmith.

The multiplicity of uses to which these improved presses and dies are now put for the saving of hand labor in forging, planing, filing, drilling, etc., it is difficult to enumerate, as there is hardly a manufacture in the country to which one or the other of them is not related, either for making the finished article or forming the machinery with which it is made. The watch-making industry, as is well known, has been revolutionized by this machinery, and there is hardly a part of a watch which is not now made by a press or a drop, or both. They have likewise caused a revolution in the manufacture of firearms, and the great precision of our modern weapons as well as their cheapness is due to the use of such machines. They are also largely used in the manufacture of tin, silver, copper, britannia, and brass ware, clock cases, locks, sewing machines, etc. Almost every description of metal cutting, trimming, punching, drawing, shaping, stamping, and forging comes within the sphere of their operation, and it is stated that of presses manufactured by this company there are over 5,000 in use in this country.

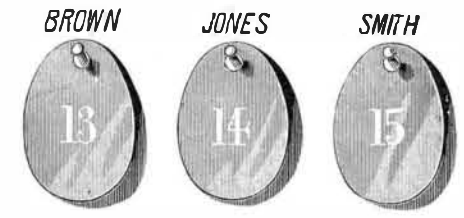
Among the work recently completed by the company are a press for making eyelets, which is calculated to turn out 8,000 a minute; a drawing press which will, at one operation, draw up clock cases 12 inches in diameter and 4 inches deep, using a blank of brass 16 inches in diameter; a press weighing 12,000 pounds, capable of punching 1 inch hole through 1 inch iron 25 inches from the edge of the sheet; a 1,000 pound drop hammer for a Connecticut firm; also a 200 pound drop for the Russian Government, this being the second one made for that government. The capacity of the establishment is being tested to the utmost by the number of orders now in hand. Among the work in progress is a large size double-acting drawing press, and a punching press to make 21,920 holes a minute, 1/4 inch diameter, through iron 1/8 inch thick, the press being calculated to make 80 strokes a minute, and 274 holes to a stroke, the feed being automatic. This press will weigh four tons, and they are making another somewhat similar which will weigh seven tons. Large and powerful as these presses are, however, they do not compare with one which the company has lately been asked to make, and the feasibility of which they are now considering, viz., a press which will make, at one time, 120 5/8 inch holes through 5/8 inch boiler iron. This is considerably beyond the capacity of any press yet made, and while the proposition marks the extreme of present development in the press manufacture, the fact that it is entertained indicates yet greater possibilities for the future.

In the engraving on the first page of this paper the group of buildings in which the business of the company is carried on is represented in one of the views. The building at the right is the foundry, which now has but one cupola, but another is in course of construction. Here is done all the casting required, and the amount of metal run usually varies between two and five tons a day. To the left of the foundry is the main building, the whole of the ground floor of which is occupied as a general machine shop, the second floor being used for making dies and patterns and as a tool room, while the top floor is filled with patterns, the accumulations of many years' work on a wide variety of machinery. To the left of the main building is the blacksmith shop and forging department, and in the rear, connecting with the main building and with the blacksmith shop, is the engine and boiler room.

In the right of the foreground of the main room, as shown in the large illustration at the bottom, is a drop anvil, the base for a drop hammer in course of construction, the upright parts of which are lying at its side. To the left of this may be seen mounted on a box, its stand not yet having been supplied, a shearing press for cutting tin, which, by an automatic fixture, throws the good blanks in one box and the scrap in another. To the rear of these, and in the center, are large punching and perforating presses nearly completed, while on both sides of the room extend lathes, planers, milling machines, etc. Some of the lathes here are of extraordinary length, for use in making shafting, while one has a capability for taking unusually wide and heavy pieces.

In the blacksmith shop, as shown in the upper right hand engraving, is a steam hammer, capable of striking a blow of 10 tons for very heavy work, and a power drop hammer for general forging. This department is conveniently arranged, and is fitted up for doing forging of almost every kind, large and small.

In the tool room, as shown in the upper left hand view, is a gear cutter, which will cut any size gear from 1 to 60 inches. Here also are milling and die sinking machines and tool makers' lathes, but the principal interest attaching to this department is in the system adopted by Mr. Stiles several years ago, of checking every workman with the tools taken by him to use in any part of the works, such check to remain against the workman until the tool is returned. As this system, or something on the same principle, has since been adopted in many other large machine shops, we herewith illustrate the plan originally started by Mr. Stiles. All the workmen who may require tools are numbered, and their names and numbers put in a rack in the tool department, with, under each man's name and number, a number of metal tags, as follows:



When a workman requires a tool from the tool room, one of the metal tags on the hook under his name is put in the tool rack in place of the tool, and there remains until the tool is returned, when the tag is again placed on its hook beneath the man's name. The number of tools out, and who has them, can thus be seen at a glance. An effectual check is thus put upon the carelessness of workmen, who might leave tools lying around after they were through with them. This, however, is only one feature of a complete system which marks the conduct of the business in every department. Each room has a competent foreman. Mr. Stiles has the general superintendence, and gives the business his personal attention.

As has been so generally the case with successful American inventors, Mr. Stiles has carved out his own way in this his chosen line of business. He was born in Agawam, Massachusetts, in 1834, where his father was a farmer, but the latter lost his property when young Norman was but five years old. His mechanical turn of mind manifested itself at an early age, and when he was but ten years old he built an extension to his father's house, doing all the work himself—carpentering, joining, painting, etc. When he was about twelve years old he built a small fire engine and a miniature working steam engine. At sixteen he earned a journeyman's wages in making tin ware; and from the age of eighteen to twenty-one, he worked as an apprentice in the American Machine Works, at Springfield, Mass. In 1857 he established a small jobbing machine shop at Meriden, Conn., and then began to pay particular attention to the making of dies and presses. From that time to the present his mechanical skill and inventive turn of mind have been principally exercised in matters pertaining to these specialties, with practical results of which we have substantial evidence in almost every machine shop in the land.

A Coal Miner's Day's Work.

In a recent article on the use of compressed air in coal mining (SCIENTIFIC AMERICAN, February 7) it was stated that a day's work for two able-bodied miners is the bearing in of 2½ feet across 15 feet of coal. Mr. Charles Wyld, of Carbon, Indiana, writes that his usual day's work is to bear in from four to six feet in depth a distance of from twelve to fifteen feet; in other words, he does twice as much in a day as was allowed for two men in the article referred to. We make the announcement with pleasure, but regret that Mr. Wyld did not say whether his fellow miners do as well as he, or whether the average bearing in under all conditions is greater than the article stated.

AGRICULTURAL INVENTIONS.

Mr. Willis D. Green, of Mount Vernon, Ill., has patented an attachment for grain drills, by which, as it follows the delivery spout, the earth is pressed about the grain, packing it more closely at the sides than at the top, and pressing the soil down, forming channels, which will be gradually filled by the falling in of the sides, thus hilling the stalks of grain as they come up.

Mr. William A. James, of St. Louis, Mo., has patented an improved sulky plow provided with novel means for readily adjusting the various parts. The invention cannot be fully described without engravings.

Mr. David A. Swanson, of Rio Grande, O., has patented a combined hand corn planter and fertilizer distributer which is so constructed that the corn and fertilizer will be deposited at the same time and at the same depth or at different depths, as required.

Mr. Chapin C. Brooks, of Lancaster, N. H., has patented a reversible or side hill plow so constructed as to turn a furrow in either direction upon level or hilly lands.

Chasse's Multiplex Telegraph.

For some months a Frenchman, named Chasse, has been promulgating the most astonishing claims with regard to an alleged new process of telegraphing, by means of which an indefinite number of messages might be sent simultaneously in opposite directions over a single wire.

A few days ago practical telegraphers were invited to witness a demonstration of the process at the inventor's workshop in Hartford, Conn. There were eighteen telegraphic instruments at each end of the room, all connected with a single wire, supposed to represent a cross country line. Eighteen messages were sent each way, all at once, apparently through the single wire.

Among the witnesses was Mr. William Hadden, of the American Union Telegraph Company, who noticed that the insulated connecting wires were neatly fastened to the wall by double-pointed carpet tacks. On pulling one out he found that beneath each tack the covering of the wire had been neatly cut away, and an ingenious system of false circuits established by fine wires leading from the tack legs. The supposed cross-country wire was a sham and the too promising multiplex telegraph a clever cheat.

A Log Railroad.

A log tramway or railroad in use by the Richardson Brothers at their mill, south of Truckee, is a very ingenious piece of machinery. Logs, ten inches or a foot in diameter, are hewn round and smooth and their ends are coupled together by iron bands. These logs, laid side by side upon graded ground for a distance of perhaps three miles, form the track. Of course the road looks quite like an ordinary railroad track, except that logs are used instead of rails, and the ties are at much greater intervals. The wheels of the engine and cars are concave on their outer surface, and fit the curve of the logs. The power is applied to a wheel in the middle of the forward axle on the engine. The most remarkable loads of logs are hauled upon the cars, and the affair is a decided success. It is very cheap, its construction is simple, it is not easily damaged, and its operation is all that could be desired. By means of this log railroad the Richardson Brothers are enabled to get their logs to the mill from the forest, three miles distant, at a cost far less than it is ordinarily done.—*Truckee (Nev.) Republican.*

Decline in the British Flax and Linen Trades.

The recent report of the British Factory Department shows a remarkable decline in the linen trade of Great Britain during recent years. In 1871 there were in England, Scotland, and Ireland 500 factories; in 1878 there were only 400, the diminution showing chiefly in factories where spinning only is carried on. The number of spindles declined during the same period from 1,553,335 to 1,264,766. The number of operatives decreased from 124,772 to 108,806. The acreage planted with flax in 1871 was 17,366; in 1878 it had fallen to 7,481. There was at the same time a large falling off in foreign imports. In the same period the exports of linen yarn declined from 36,235,625 pounds to 19,216,001 pounds; and the export of linen manufactured goods from 220,467,476 yards to 177,776,527 yards.

BENJAMIN FISH, of Trenton, N. J., has rounded up 94 years of a remarkable existence. He lent Commodore Vanderbilt $1,000 when that gentleman first started out in his career; brought down the first anthracite coal that descended the Delaware in 1823; managed the old stage line and steamboat company between New York and Philadelphia, fifty-five years ago; was one of the first directors of the Camden and Amboy Railroad, in 1830, and has been elected every year since. In 1833 he drove the first freight car that moved over the road between South Amboy and Bordentown. Horses were used that year. The first locomotive was imported from England; it is now standing in the shops at Bordentown, and is known as "Johnny Bull" and "Number One."—*Railway World.*